日本動物學彙報

第一卷

明治三十年發兌

ANNOTATIONES ZOOLOGICÆ JAPONENSES

AUSPICIIS

SOCIETATIS ZOOLOGICÆ TOKYONENSIS

SERIATIM EDITÆ.

Volumen I.

Cum VII tabulis et XVI figuris in texto.

TOKYO.

1897.

CONTENTS.

Partes I et II.

Published May 25, 1897.

Pars III.

Published August 10, 1897.

Pars IV.

Published November 5, 1897.

Erratum.

In Mr. Ikeda's paper beginning at page 113 read *Rhacophorus* instead of *Racophorus*.

INTRODUCTORY.

The duty of introducing the present modest publication to our fellow workers of other lands, and of explaining its aim and scope, having fallen on me, I feel that I can do this in no better way than by offering a brief retrospect of the progress of our science in Japan.

Until within a comparatively recent time, Japan was a sealed book to Europe. The name of our country stood in the West as the symbol of things strange, remote and antipodal. In the minds of Europeans, Japan has never been associated with science, except as an object of investigation; and, if I mistake not, they would find something almost incongruous in the idea of contributions to the progress of modern science from Japanese sources. But if such a conception exists, it rests, I verily believe, on entirely unjust grounds. A slight acquaintance with the history of Japan would enable any one to see without much difficulty that a high degree of culture was attained at an early age in our land, and that there has ever been abroad a spirit of earnest study among our people. It would take me too far away from my immediate object to do any thing more than mention the existence of those masterpieces in literature and art which were produced in the period extending from the seventh to

the tenth centuries of the Christian era and which have been the despair of all who have striven to emulate them in succeeding ages. But I may perhaps be allowed to cite a few facts having a closer connection with our subject, which would, I believe, go far to substantiate what I have claimed for my country.

It is probably unknown to most persons in the West that early in the eighth century of the Christian era there was already established in Japan an Imperial University with four departments,—Ethics, History, Jurisprudence and Mathematics,—and with the prescribed number of four hundred students. There were also at the same time a bureau devoted to Astronomy, Astrology, Calendar-Compilation and Meteorology, and a Medical College with professors of Medicine, Surgery, Acupuncture, Necromancy (the art of healing by charms) and Pharmacology. The last named branch of study included the collection, cultivation, and investigation of medicinal plants, and thus a considerable amount of botanical knowledge must already have been acquired by that time. Toward the end of the ninth century, when a catalogue of books existing in Japan was compiled by the order of the then reigning Emperor, the Imperial library was found to contain 16,790 volumes, divided into forty departments,—and this in spite of a disastrous fire of some years previous. Among the medical works were some with very modern sounding titles, such as "The Curing of Diseases of Women" and "On the Methods of Healing Diseases of the Horse." Japan in those early days derived its culture from India, China, and Corea, but the details above enumerated clearly show that educated society must already have attained a high degree of civilization.

Coming to more modern times, it is known that, during the

long peace of two hundred and fifty years which the rule of the TOKUGAWA *shoguns* secured for Japan, literature, the arts, and all peaceful industries were developed with remarkable vigor and rapidity, and that the study of Natural History shared in this progress. Apart from that innate love of Nature and the natural which was ever showing itself in poetry and other arts, the study of natural products was always pursued, ostensibly with the purpose of collecting *materia medica*, or of discovering things that might be used as food in case of a famine, or of identifying objects mentioned in the Confucian classic, "Shi-King." But it is not difficult to perceive that naturalists looked in reality beyond these simple or utilitarian ends, and investigated animals and plants for their own sake, although the principal aim of their researches seems to have been the comparatively barren one of establishing a relationship between Japanese products and those described in various Chinese works on Natural History. Frequent were the excursions and expeditions undertaken with the view of collecting natural objects, among which plants were especial favorites, and all parts of the country seem to have been tolerably well explored in this way. Numerous were the treatises on Natural History, published or unpublished. Many of these were encyclopedic in their comprehensiveness and size, such as "*Shobutsu Ruisan*," by INAO JAKUSUI, (1000 parts, early in the eighteenth century), and "*Honzō Kōmoku Keimō*" by ONO RANZAN (48 parts, 1803). The last named naturalist was so famous for his extensive knowledge that we are told, his pupils were nearly one thousand in number. My colleague, Prof. MATSUMURA, in his book on the enumeration of Japanese plant-names, gives 306 titles of Japanese works on botany

compiled previously to 1868. Many of the Natural History volumes had beautiful colored illustrations, which serve their purpose even at the present day. Natural History displays were of common occurrence, when naturalists came together with their treasures, and showed them to one another and to the public. Of these the exhibitions given by HIRAGA GENNAI in the middle of the eighteenth century were perhaps the most celebrated. The present Botanic Garden of the Imperial University was established early in the TOKUGAWA period, viz. in 1681, and was long renowned as the "*O Yaku En*" (Garden of Medicinal Plants). The mastery of the Dutch language by a few earnest physicians in the middle of the eighteenth century has always seemed to me one of the greatest triumphs ever achieved by patient scholarship. Originally undertaken with the purpose of ascertaining something about Western medicine, their efforts soon exerted an influence on all branches of learning. The whole rich treasury of Western civilization became suddenly accessible through the channel thus opened of the Dutch language. It is not possible to overestimate the effect of the new acquisition on the progress of Japan. Suffice it here to say that the country would not be what it is to-day, but for this leaven which had been working through and through the whole mass of society for over a hundred years before the Restoration of 1868 enabled it to bear its legitimate fruit. This innovation, together with the visits of THUNBERG (1775) and SIEBOLD (1821), had due effect upon the Natural History studies also. The system of LINNÉ, especially in regard to plants, seems to have been well grasped, with very little delay. The most famous productions of the new school on Natural History subjects are pro-

bably "*Shokugaku Keigen*" (Elements of Botanical Science) by UDAGAWA YOAN, 1835; and "*Sōmoku Zusetsu*" (Icones Plantarum) by IINUMA YOKUSAI, 1832;—the latter being a standard work at the present day. It is perhaps a circumstance interesting enough to record, that a work on the use of the microscope was published in 1801.

Looked at from the modern standpoint, the Natural History of the pre-Restoration period (before 1868) was without doubt strongest in Botany. Our science of Zoology seems to have been greatly backward in its development, compared with that of the sister science, and its study was probably similar in method and aim to that of the Middle Ages in Europe. It seems to have concerned itself mostly with making commentaries on Chinese works of Natural History, like "*Honzō Kōmoku*" or with identifying Japanese objects with names given in those writings. Excepting a little on birds, fishes and shells, hardly any work that can be called scientific in any modern sense, seems to have been accomplished. Nevertheless this school did an immense service by showing that the study of natural objects was worth the best efforts of intellectual men. Names like ARAI HAKUSEKI, INAO JAKUSUI, KAIBARA EKKEN, ONO RANZAN* are among the most honored in the annals of our learning.

With the Restoration of the Emperor to his full power, in 1868, came the wholesale reconstruction of all political institutions, and the country has been, and is still, going through such a social revolution as has seldom been witnessed in any part of the world. Along with many other things, the old school of Natural

* All these names are given in the Japanese fashion, with the surname first.

History was swept away, as chessmen from the board at the end of a game. So far as our science is concerned, there is a complete break at this period. The modern school of Zoology dates from the appointment of Prof. E. S. MORSE of Salem, Mass., U. S. A. to the chair of Zoology at the University of Tokyo, in 1877. His indefatigable zeal and genial manners won many friends for the new science among all classes of society, while his lectures, popular or otherwise, drew attention for the first time to the immense strides which our science, under the stimulus of Darwinism, was making in the West. He, with a few students under him, also soon had in working order a tolerably good museum—the nucleus of the present Zoological and Anthropological collections of the Science College. It was also during his stay and through his care that the Tokyo Biological Society, from which the Tokyo Zoological Society is directly descended, was first organized. It is truly wonderful how much he accomplished in the brief time he was in Japan. On the return of Prof. MORSE to America, he was succeeded by Prof. C. O. WHITMAN, now of the University of Chicago. It was the latter who first introduced modern technical methods. These two Americans, MORSE and WHITMAN, thus stood sponsors to the modern school of Zoology in Japan.

Since 1881, the development of Zoology in this country has been entirely in the hands of Japanese.* The spirit of earnest

* Some who read this statement may consider that I have not given due credit to those zoologists from other countries who have lived in, or visited, Japan from time to time. It is certainly as far as possible from my intention to slight the labors of HILGENDORF, DÖDERLEIN, PRYER and others, but the fact remains that the recent development of the zoological school in Japan has been almost entirely independent of these men. It is a pleasure to me to add that Mr. OWSTON of Yokohama has been very active in unearthing the treasures of the deeper parts in the Sagami Sea.

study which signalized the Natural History School of the pre-Restoration days is happily revived, but with higher and wider purposes, and with greater facilities for successful attainment. Though only twenty years have passed since the "new departure," a vigorous school of Zoology has already sprung up. I shall perhaps not be overstepping the bounds of modesty, if I say for my *confrerès* that a more earnest, more enthusiastic, or more industrious set of men could with difficulty be found anywhere.

There can be no doubt that the establishment of the Marine Station at Misaki, by the Imperial University, in 1887, gave a great impetus to the study of Zoology in Japan. Situated at the point of the peninsula jutting out between the Bay of Sagami and the Bay of Tokyo, it has access to localities long since famous as the home of some remarkable forms of animal life. Along the coast, all sorts of bottoms are found, yielding a rich variety of animal forms, while the hundred-fathom line is within two or three miles of the shore, and depths of five hundred fathoms are not very difficult of approach. The existence of a remarkable deep-sea fauna in these profounder parts has been ascertained within the last few years, and zoological treasures are now being constantly hauled up. The great "Black Current" (*Kuro Shiwo*) sweeps by, not many miles out, and a branch of it often comes into the very harbor of Misaki, gladdening the heart of the Plankton explorer. Face to face with this inexhaustible treasury of animal forms, the zoologist will have to possess unusual powers of self-restraint, indeed, not to grow enthusiastic over his science.

By the year 1888, the number of those devoted to the study of Zoology in our country had so far increased that the need of an

organ of their own was felt. Thus was established in that year, under the auspices of the Tokyo Zoological Society, a monthly publication entitled the "*Dōbutsugaku Zasshi*" (Zoological Magazine). This had a twofold design; first, to serve as a means of communication among followers of the science in Japan, and secondly to spread the knowledge of Zoology among non-specialists, especially among teachers of the subject in primary and middle schools. The periodical is in the Japanese language, and popular as well as special papers have been published side by side. The Magazine is now in its ninth volume.

About the same time, the Journal of the College of Science, Imperial University, was established. Thus was opened a convenient channel for carrying abroad the intelligence of scientific investigations conducted in Japan, and those who look over the ten volumes of the Journal will see that zoologists have not been slow in availing themselves of the opportunities afforded.

The prospects of our science in Japan have never been brighter than they are at this time. All of its main branches, including applications of it to practical purposes such as Fisheries, Sericulture, Entomology, etc. are now fairly represented. Each year will see gradual additions to the specialists of different groups, as the number of graduates from the Imperial University increases. The Marine Station at Misaki, which has become too small for our growing body, will be removed within the present year to a new site, about two miles north of its present location, and its accommodations will be considerably enlarged. While perhaps not essential to the pursuit of science, the extreme beauty of the situation, which commands a matchless view of

Fujiyama and the Sagami Bay, will certainly not lessen its attractions; and an additional charm to those who are interested in the heroic achievements of the past may be found in the associations with which the spot abounds, as the ancient stronghold of a mighty warrior chieftain who was killed here in a desperate battle, after sustaining a long siege, and whose spirit is believed by the populace still to haunt the scene of his former greatness. A proposed railway, passing near the new site, will bring the station within two or three hours of Tokyo. A number of teachers scattered over different parts of the country are acting somewhat as sentinels at the outposts of our science, and doing good service in collecting animals from different localities. Our field of activity has also lately been suddenly widened by the addition of Formosa to the territory of Japan, and the work of a collecter now on that island will, it is hoped, be but the forerunner of many similar undertakings. Hardly a week now passes without something new turning up in the line of our study, and that something is often of great interest.

Under these circumstances, it has seemed to us very desirable that there should be opened some channel for communicating the progress of our science in Japan to fellow-workers in other countries;—some channel less formal than the Journal of the Science College, and one through which even little things may be made known. A beginning was made in this direction about two years ago, when a department written in European languages was added to the Zoological Magazine, which has perhaps become known, through this feature, to some who read these lines. We now feel justified in taking another step forward. Arrangements are

now completed for publishing the part written in European languages in an issue entirely separate from the purely Japanese text of the Magazine. The latter will now go on, containing simply articles in our own language, and will be intended for internal circulation, with its original twofold object. The present publication will take the place of the foreign language part, and will be primarily for the purpose of making the progress of Zoology in Japan known abroad. It will be distributed among laboratories, museums, educational institutions, and various societies of different countries, much more extensively than was attempted with the Zoological Magazine. We regret that the limited funds at our command do not allow us to publish at as much length, or to make use of as good plates, as we desire, but it is hoped that in time there will be a marked improvement. For the present, the ANNOTATIONES will be issued quarterly, four numbers constituting an annual volume.

In future, therefore, zoologists of other countries may look for contributions to their science from Japanese sources in two publications :—for more extensive or monographic works in the Journal of the College of Science, Imperial University, and for shorter, less formal or preliminary notices in the present periodical.*

On behalf of my fellow-zoologists of Japan, I should like to make here an earnest appeal to societies, institutions and individuals, the world over, to help us in our efforts, by sending their publications to us. We who are so far from the centers of our

* There are some other publications in which papers on zoological subjects are published from time to time, for instance, Bulletin of the College of Agriculture, Imp. Univ. It is our intention to call attention to them in this journal, whenever occasion arises.

science in Europe and America appreciate this favor more keenly, I think, than those situated more favorably have any idea of. Publications may be sent either to the Tokyo Zoological Society or to the College of Science.

We now send forth this magazine to our fellow-workers in other lands, asking their lenient judgment for whatever shortcomings it may exhibit, and hoping that it will aid in promoting that fraternal feeling which must ever be characteristic of international Science.

SALVE!

K. MITSUKURI, Ph. D.
Professor of Zoology, Imperial University,
and President of the Tokyo Zoological
Society for 1896-7.

Pear-borer

(Nephopteryx rubrizonella, RAG.).

By **M. Matsumura.**

Agricultural College, Sapporo, Hokkaido.

With Pl. I.

There are two species of our pear-borers belonging to the genus *Nephopteryx*, the present one being much larger than the other. In 1889, the smaller species was described by Mr. S. IKEDA of the Agricultural College of Tokyo, in the Zoological Magazine, Vol. 1, page 99; but its life history was not known clearly at that time. By this larger borer our pear growers have been losing every year 30–50% of their crops, it being a much more troublesome insect than the apple-borer I have described in a recent number of the Zoological Magazine. Entomologically it belongs to Microlepidoptera, group Pyradina, family Phycidæ, and its generic and specific name was kindly identified for me by Mr W. J. HOLLAND of Pittsburg, through the kindness of Mr. O. HOWARD, the first Entomologist in the Department of Agriculture, U. S. A.

Imago—Antennæ curved over the basal joint, the latter with a scaly tuft; labial palpi compressed, with a long end joint; maxillary palpi small and filiform; anterior wing with 11 veins, branches 4th. and 5th. not being stalked; ground color varying form grayish brown to grayish black, crossed by two equidistant irregularly sinuated, grayish bordered black lines. Outer margin and basal half much deeper in color, with a black disco-cellular marking in the middle of the wing. Hind wing dark gray, with 8 veins, branches 3rd., 4th., and 5th. springing from a common stalk which rises from a hind angle of the closed mid-cell.

Thorax is of the same color as the anterior wing, abdomen much paler ; hind tibia large and compressed, with 4 spines. Wing expanse 25 mm., body length 12 mm. ; two broods in a year, first middle July, second late September to early October.

Eggs—These are placed just under a small twig where the rain does not strike directly, protected safely by a white silken web. The eggs under that cover are about 20 in number ; oblong in shape, both ends being a little narrower ; very flat ; black in color ; 0,7 mm. × 0,4 mm. in size and hybernating through the winter in this state.

Larva—The larvæ hatch in early june, just at the time when the pear attains the size of a cherry, at first spinning much silken thread on the branches and then making their way to different fruits near by. To the injured fruits are attached almost always silken threads just at the place of branch, where a fruit stalk hung. At first whitish in color, with black head and black first segment, the larvæ gradually change in color to grayish yellow ; and when fully mature, they take a pinkish brown color, measuring about 20 mm. in length. They are spindle shaped in general, consisting of 12 segments, of which the 6th., 7th., and 8th. are the largest ; head brownish black ; the upper part of the second segment with 2 pitchy black horny spots ; legs show nothing unusual. They injure only the core of pears and as they leave always a large blackish opening at their entrance, it is easy to detect their presence. The larval stage lasts 3 weeks or more ; the insects I cultured have made cocoons on the 30th. of June. Food plant only pear.

Pupa—It always changes to pupa within the core of the fruit spinning very little silk ; it is deep red brown in color, head, thorax and wing portion being much more so ; it measures 13 mm.—15 mm. in length ; pupal stage lasts more than 2 weeks.

Preventive method—The most effectual preventive method is to take off the eggs during winter months, as they are easily recognizable by their whitish web cover at the branches. For this purpose pruning is indispensable, eggs being almost always on the top of the branches ;

and when pruned they must be immediately burnt up; the remaining branches must be carefully searched for. The eggs are always placed near the hybernating nest of the pear leaf roller *Rhodophæa hollandella*, Rag. Kerosene emulsion is very beneficial after pruning as well as in early June, namely the time of larvæ hatching, for it kills at the same time the larvæ of the leafroller. After they bore into the fruit, no remedy is accessible, except carbon bisulphide, but this chemical being very expensive I only used it on a dwarf tree, pouring it with a small brush into the hole, through which insect entered; it very soon kills the insect and no injury was done to the fruit. Benzole also has the same effect, but inferior, and little injures the fruits. Now in our College garden, picking of the injured fruits by hands is the only means resorted to, as they are easily recognizable by their black holes and brown excrements. Lamp is of no use.

Entomological Laboratory,
Agricultural College, Sapporo.
Jan. 5th. 1897.

Printed April 30, 1897.

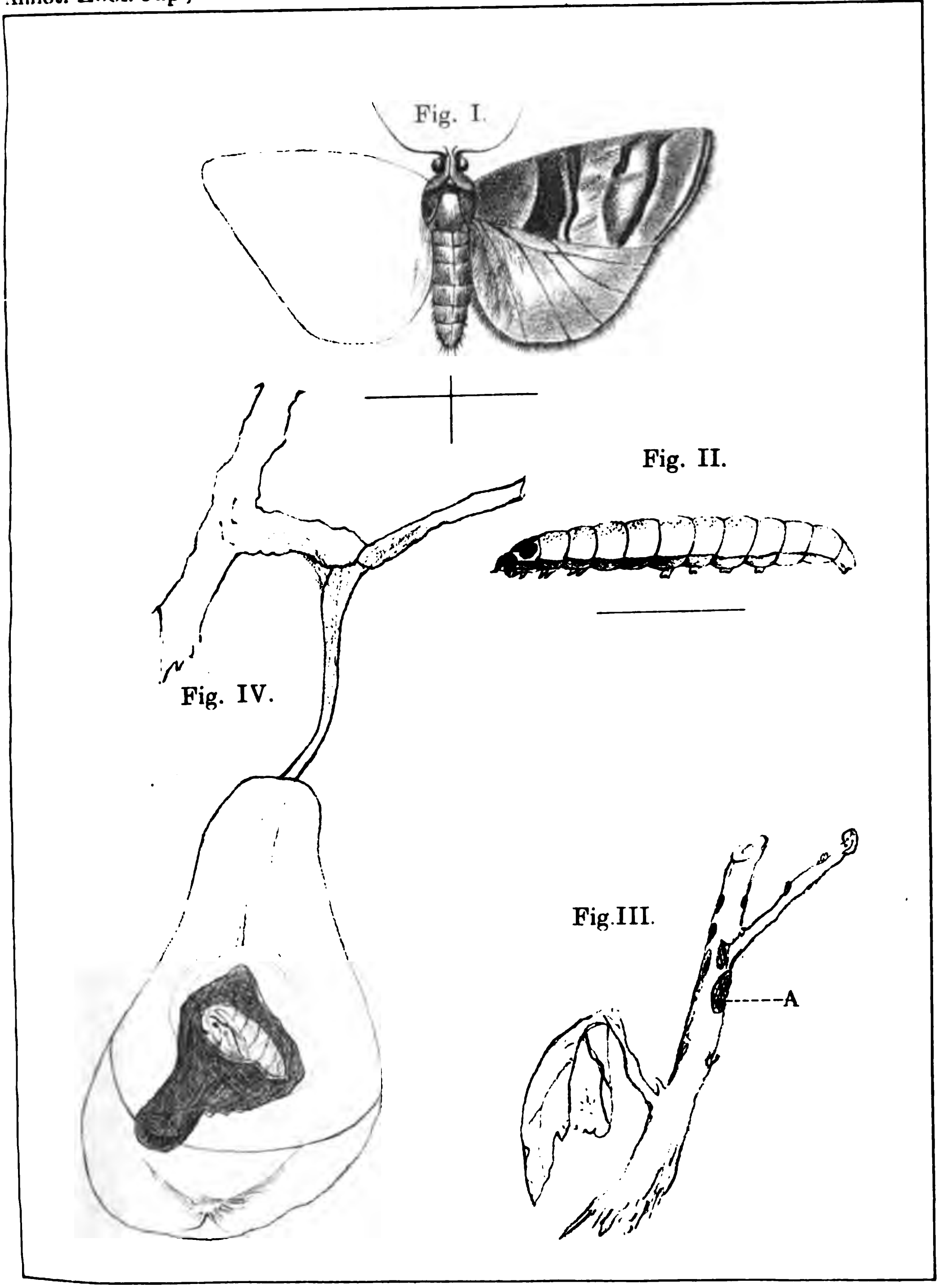


Fig. I ; Imago enlarged.
Fig. II ; Larva.
Fig. III, A ; Eggs under the Silky Cover.
Fig. IV ; Pupa in the Pear.

On Two New Species of Asthenosoma from the Sea of Sagami.

By S. Yoshiwara.

Zoological Institute, Science College, Imp. Univ., Tokyo.

With Pl. II.

The Echinoid collection of the Science College Museum contains, amongst others, five interesting specimens referable to the genus *Asthenosoma,* of which I propose to make two new species as described below.

Asthenosoma longispinum, nov. sp.

(Figs. 1–7.)

Four specimens of this species have been obtained from a depth of 313–376 fathoms in Sagami Sea.

Test flexible, disc-shaped, flat actinally, depressed abactinally, somewhat polygonal in ambital outline. Dimensions of the largest specimens: 135 mm. in diameter and 18 mm. in height. Color of covering membrane dark red as preserved in alcohol.

Plates numerous. In a specimen of 110 mm. in diameter, there are in a vertical row: actinally, about 17 interambulacral and about 23 ambulacral plates; abactinally, about 30 interambulacral and more than 30 ambulacral plates. Plates overlapping as in other species of the genus. Between every two interambulacrals in vertical succession, there exists actinally a considerable membranous area in the middle, but abactinally this membrane is reduced to a minimum, and the plates overlap one another even in the middle of transverse sutures, although

in a very slight degree. Close to the periproct again, the overlapping just referred to is not recognizable.

Apical system (fig. 5) star-shaped, not projecting, the plates lying partly in apposition, partly separated by more or less wide membranous interspaces. The larger and peripherally situated apical plates with tubercles for pedicellariæ and secondary spines. Basals (*bas.*) wedged into interambulacrum and bearing a short membranous tube with genital opening (*g. o.*). Radials (*rad.*) separated from basals, usually with a periproctal (*per.*) between. Anals (*an.*) very small, elongated, closely packed together. Anus somewhat projecting.

Ambulacrum straight, narrower than interambulacrum (the ratio of breadths of the two being 28 to 41 at ambitus).

Ambulacral plate is composed, as determined near ambitus, of an aboral section and of a small, narrow, imperfectly calcified, adoral section situated at the middle of lower edge (fig. 6, *am.*). Closer observation shows that the former again consists of three pieces apposed together in a transverse row. A pair of pores is situated on the outermost piece of the aboral section. This pair of pores, together with two more pairs found side by side on the adoral section, forms a tolerably broad poriferous zone.—Towards the periproct the divisional lines between the pieces making up the aboral section become more and more difficult to distinguish and towards the periproct the adoral section apparently loses one of its pairs of pores, so that there now remain only two pairs of pores to each ambulacral (fig. 5, *am.*). Finally the adoral section itself is no longer recognizable as such and henceforth the row is continued to the periproct by a few, very imperfectly calcified plates, each with a single pair of pores.

Peristomal ambulacrum consists of transversely narrow plates, each with a single pair of pores. They are arranged in each peristomal ambulacrum in two regular rows reaching the mouth, between which are irregularly interposed a few other plates confined to the peristomal periphery. The pairs of pores on the two rows form a continuation of the outermost series of those of the coronal ambulacrum. Those of

interposed peristomal ambulacral plates form one or two irregular series.

Tentacles of abactinal side, as also those situated near or within the peristome, are smaller, more pointed and poorer in calcareous networks, than the remainder of those of actinal side. They are also destitute of calcareous discs present in the latter. Calcareous networks of tentacles show special concentration along two symmetrically situated lines on either side.

For the distribution and arrangement of large and small tubercles on both ambulacrum and interambulacrum, the reader is referred to figs. 3 and 4.

Ambulacral arch of the perignathic girdle encloses a somewhat triangular space. The circumferential surface of the arch shows roughness at top for insertion of retractor muscles. On the other surface there is roughness along its inner edge for insertion of the muscle characteristic of the genus. Interambulacral ridge of the girdle possesses two slight prominences. Close observation shows at once that here the ridge is formed of one or two interambulacral plates derived from each of the two rows that compose an interambulacrum, and that each limb of the arch is formed by modification of a single ambulacral plate—a condition that reminds us of what occurs in the *Cidaridæ*. The sutures between all the plates composing the perignathic girdle remain distinct.

Spines perforated, of four kinds: 1) long poison-spines, which are smooth, cylindrical, tapering, of reddish color; some as long as 60 mm. or more; found scattered all over abactinal side; 2) stout hoof-capped spines (fig. 7) similar to those generally found in *Phormosoma* with shaft crenulated in upper part, found on abactinal side from a short distance within ambitus and extending to peristomal margin; 3) small slender spines like poison-spines but more or less crenulated and covered with thicker membrane containing red pigment, occurring intermixed with the two foregoing kinds; 4) those found thickly crowded in proximity of peristome, densely crenulated and slightly

curved, with the concavity facing the peristome.

Pedicellariæ of two kinds: small slender-stemmed trifid ones and larger but short-stemmed cup-bearing ones. Both distributed all over coronal, periproctal, and peristomal plates.

Sphæridia large, 1 mm. in length, arranged in a single series closely inside the innermost series of tentacles, not only on actinal side but also on abactinal side up to one-fourth of the way from ambitus to periproct. Their membranous covering contains red pigment; the club-shaped calcareous body has numerous canals longitudinally traversing the neck. These open mostly on the surface of neck, while only three of them pass into the head to open there.

Branchia with branches that are either simple and finger-shaped or lobose at end. Stome pentagonal. Jaws unclosed above with epiphyses. Tooth keeled.

Amongst other points of structural differences, the present species may be readily distinguished from all other species of the genus by the presence of very long spines on the abactinal, and of hoof-capped spines on the actinal side.

Asthenosoma Ijimai, nov. sp.

(Figs. 8–12.)

The following description of this species is based on a single specimen which was purchased by Prof. IJIMA from a Jōgashima fisherman in a fresh state. It was stated that it came up sticking to the fishing net. The locality of its capture must have been not very far away from Misaki, but the exact depth is unknown, although we can safely assert that the particular kind of net used by that fisherman is never let down to a depth beyond 55 fathoms.

Test similar in shape and nature to that of *A. longispinum*, Yosh., but proportionally higher. Diameter 132 mm., height 40 mm.; color as preserved in alcohol light yellow with dark brownish spots and irregular markings.

Plates very numerous. In a vertical row of interambulacral plates

there are about 36 plates abactinally and about 26 plates actinally. The number of ambulacral plates almost twice that of interambulacrals.

Apical system (fig 11) polygonal, projecting. Anus very prominent. Anal plates (*an.*) minute, of an elongated shape, few, not reaching anal margin. Periproctal plates (*per.*) with pedicellariæ and small spines. Basal plates (*bas.*) unclosed, leaving around the genital opening (*g.o.*) a narrow membranous tract (*bas'.*), containing numerous small calcareous pieces and networks and extending as far down as the 8th.—10th. plates along the median interambulacral line. Madreporic plate divided into 4 separate pieces of unequal size (*mad.*), the largest occupying the normal position. This division of madreporic plate is probably merely an individual abnormality.

Ambulacrum straight, 20 mm. wide at ambitus. The arrangement of ambulacral plates both coronal and peristomal, as also that of the pairs of pores, essentially same as in the foregoing species.

Tentacles of abactinal side pointed, containing exceedingly minute calcareous pieces in a small quantity. In the proximity of ambitus, first the inner tentacles and soon also the outer tentacles begin to be provided with calcareous discs, as are all on actinal side except those on peristome. The latter are simply provided with calcareous network.

Tubercles of both ambulacral and interambulacral areas show marked difference on actinal and abactinal sides.

Primary tubercles of interambulacrum: these appear from the 23rd. plate (counting from periproct) in the proximity of ambitus on abactinal side, corresponding to the appearance of tentacles with discs. Down to the 33rd. plate they occur on alternate plates and form a single row running close to ambulacrum (*in.*, fig. 9). From the 34th. they occur on every successive plate and form two rows down to the 42nd. plate. Plates 43rd. to 47th. have alternately two and three primary tubercles giving rise to five rows (*in.*, fig. 10). Plates 48th. to 55th. with two primary tubercles each, forming four rows. Finally, plates 56th. to 62nd. with one primary tubercle each, forming two rows.—Secondary tubercles of interambulacrum: abactinally, up to 10 in a

regular transverse row on each plate (*in.*, fig. 9). Actinally, rather irregularly scattered between primary tubercles (*in.*, fig. 10).

Primary tubercles of ambulacrum: these appear at about the same level as those of the interambulacrum, in a single interrupted row along the median ambulacral suture (*am.*, fig. 9). On actinal side (*am.*, fig. 10) they occur one to each plate but so as to form two regular rows on the inside of poriferous zone. Towards the peristome, these rows become more or less interrupted.—Secondary tubercles as on interambulacral plate, only fewer.

Spines perforated, of four kinds: 1) poison-spines, which are smooth, pointed and with transverse bands of a brownish color; found all over the abactinal side, where they may be as long as 16mm., and also on the peripheral half of the actinal side, where they are mostly short and do not exceed 7 mm. in length; 2) stout, slightly bent, cylindrical spines, truncated at free end and borne on all primary tubercles, consisting of crenulated shaft and of simply striated, short, terminal segment open at end (fig. 12) as long as 22 mm., 3) shorter spines, covering the main portion of the actinal side, straight, tapering, cylindrical or slightly flattened, mostly smooth; 4) short spines on the peristome and adjoining parts, club-shaped, curved, flattened, crenulated, with thick sheath of the soft part.

Pedicellariæ of two kinds: one large and long-headed, the other small, long-stemmed and trifid.

Branchia with branches that give off numerous, closely set, lobose branchlets.

The most prominent feature by which this species can be distinguished from all known members of the genus, lies in the peculiar arrangement of the primary tubercles.

Explanation of Plate II.

Asthenosoma longispinum, Yosh.

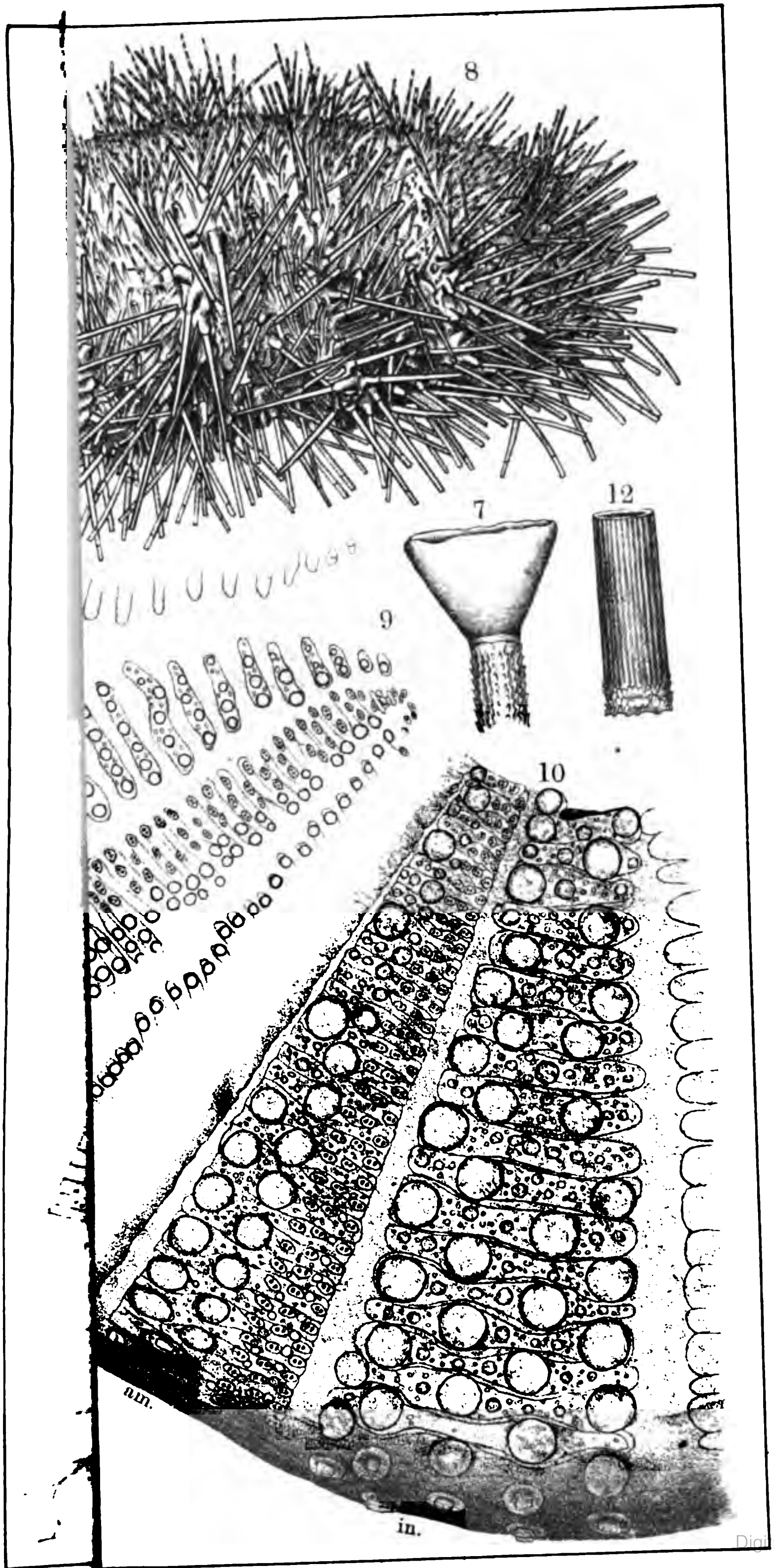
Fig. 1. Portion of abactinal side. Nat. size.
2. Portion of actinal side. Nat. size.
3. Arrangement of tubercles on abactinal side. Semi-diagrammatic. *in.* interambulacral row ; *am.* ambulacral row.
4. Arrangement of tubercles on actinal side. Semi-diagrammatic. Lettering as in foregoing figure.
5. Portion of periproct and of adjoining coronal plates. Magnified. *an.* anal plate ; *per.* periproctal plate ; *bas.* basal plate ; *g. o.* genital opening ; *mad.* madreporic plate ; *rad.* radial plate ; *in.* interambulacrum ; *am.* ambulacrum. Portions of plates not covered with membrane are shaded.
6. Adjoining ambulacral (*am.*) and interambulacral (*in.*) plates near ambitus. Magnified.
7. End of hoof-capped spine. Magnified.

Asthenosoma Ijimai, Yosh.

Fig. 8. Portion of profile view. Nat. size.
9. Portion of abactinal side of test, showing two rows of ambulacral (*am.*) and interambulacral (*in.*) plates. ×2.
10. Portion of actinal side of test, showing two rows of ambulacral (*am.*) and interambulacral (*in.*) plates. ×2.
11. Portion of periproct and of adjoining coronal plates. Magnified. Lettering as in fig. 5.
12. Terminal portion of primary spines, showing the terminal segment and a small portion of the crenulated shaft. Magnified.

Printed April 30, 1897.

Tab. II.



Chaetognaths of Misaki Harbor.

By **T. Aida.**

Zoological Institute, Science College, Imp. Univ., Tokyo.

With Pl. III. & one wood-cut.

During the frequent visits made to the Marine Zoological Station of the Imperial University at Misaki for the last two years, I have devoted myself specially to the collection of the chaetognaths to be found in the harbor. Up to date, I have been able to collect twelve species in all. The majority of these can not, however, be fished at all seasons of the year, as their presence depends a great deal on current and wind. For instance, late in summer last year, when an offshoot of the Great Black Stream (*kuroshiwo*) swept into the harbor, many species not to be seen at other times were caught. I do not therefore think that the list here given is by any means exhaustive. Other species will no doubt be added hereafter from time to time.

Of the twelve species mentioned below, four I believe to be new to science. I have adopted the classification of Langerhans (1), as it appears most convenient to me.

1. *Sagitta bipunctata*, Quoy *et* Gaimard.

(Fig. 1.)

Literature: Langerhans (1), Hertwig (2), Grassi (3), Strodtmann (4).

The specimens which I refer to this species present characters agreeing essentially with the descriptions given by the authors cited above, the agreement being especially noticeable in the position and size of the fins, the thickness of the epidermis, the form and position of the *corona ciliata*, the length of the body and its ratio to the length of the caudal segment, the size of the ovaries, and a few other points. But

there are some discrepancies in the number of the seizing hooks and teeth. Our specimens have 6–7 seizing hooks, 10–12 anterior teeth, and 18–21 posterior teeth, while GRASSI (3) and STRODTMANN (4) give for European specimens 8–10 seizing hooks, 4—6 anterior teeth, and 10–15 posterior teeth. Thus our specimens have a greater number of teeth and a smaller number of seizing hooks than those of Europe. Notwithstanding this difference, I think it correct to refer them to the same species, as they agree in so many other characters.

2. *Sagitta serratodentata*, Krohn.

(Figs. 2 & 8.)

Literature: GRASSI (3), HERTWIG (2), STRODTMANN (4).

This species is rare in Misaki, and I caught only three during the spring of 1896. It resembles closely *Sagitta bipunctata*, but is distinguished from it by its serrated seizing hooks, thinner epidermis and smaller size.

Strodtmann (4) states that the tip of the teeth is distinctly star-shaped in this species and has at its center the opening of the canal which runs through the body of the teeth. But I was unable to find such an opening in the teeth of our species. The canal ends at the top of the teeth blindly and four processes of different size surround the top (fig. 13).

3. *Sagitta hexaptera*, D'Orbigny.

(Fig. 8.)

Literature: LANGERHANS (1), HERTWIG (2), GRASSI (3), STRODTMANN (4).

All the specimens of this species which I have fished are young, with unripe genital organs. The pear-shaped *corona ciliata* on the head segment, the wide lateral field, the number of the seizing hooks and teeth, and the shape and position of the lateral fins, all point to the [illegible]tity of this species with that described by European authors.

4. *Sagitta lyra*, Krohn.

(Fig. 4.)

Literature: LANGERHANS (1), HERTWIG (2), GRASSI (3), STRODTMANN (4).

I fished only a few individuals of this species together with *Sagitta hexaptera* during the spring of 1896. The largest specimen I have caught was 3 cm. long, and its caudal segment 4.5 mm., but its genital organs were not ripe.

This species has a very wide trunk and a narrow caudal segment, and two pairs of lateral fins which are continued into each other, the first pair being long and extending anteriorly to the level of the abdominal ganglion.

5. *Sagitta minima*, (Grassi).

(Fig. 5.)

Literature: GRASSI (3), STRODTMANN (4).

This is a small-sized species. The larger individuals reach the length of 1 cm. and its caudal segment the length of 1.5 mm.

The epidermis is thin. The lateral field is pretty wide. As the body is widest in the lower part of the trunk and the caudal segment is comparatively narrow, it is constricted at the border of these two segments as in *Sagitta lyra*. The top of the seizing hook is strongly curved inwards. The ovaries are short, and generally terminate at the level of the anterior end of the second lateral fin. The *corona ciliata* is elliptic and lies wholly on the trunk segment. The intestine is very wide, nearly filling up the body cavity, and shows here and there transverse wrinkles. It has two diverticula at its beginning.

6. *Sagitta enflata*, (Grassi).

(Fig. 6.)

Literature: GRASSI (3), STRODTMANN (4).

This species is abundant in Misaki. It can be fished at all seasons

of the year, though the number differs according to meteorological conditions. The length of the body when fully grown is 12mm. and its breadth 1.6mm. The caudal segment is 2mm. The anterior pair of lateral fins lies midway between the abdominal ganglion and the posterior end of the trunk segment. The second pair is much larger, and extends along the lower part of the trunk. to the middle of the caudal segment. The eipdermis and the muscular coat are very thin. The ovaries are small and scarcely reach the upper end of the second lateral fin. The head is comparatively small, and has 9–10 seizing hooks. 6–8 anterior teeth, and 10–11 posterior teeth. The *corona ciliata* is skein-shaped and lies on the head segment. The ratio of the length of the caudal segment to that of the whole body is, in our specimens $^1/_5$—$^1/_6$, thus differing from that given by GRASSI, which is $^1/_4$.

7. *Sagitta neglecta*, nov. sp.

(Fig. 7.)

This is the smallest sized species. The whole length of the body is 7mm., that of the caudal segment 1.7mm., and the breadth 0.35mm. The fins are five; the first pair of fins begin at the posterior end of the ventral ganglion; the second pair, which is separated from the first, is longer, extending to the middle of the caudal segment. Both lateral fins are semi-elliptic. The *corona ciliata* is long, like that of *Sagitta bipunctata*, and lies wholly on the trunk segment, never extending to the head segment between the eyes. Seizing hooks 8; posterior teeth 10–12, anterior teeth 4–5. The top of each tooth has fine processes. The ovaries reach the upper end of the second pair of fins. The spermatic vesicle is comparatively large. The epidermis thickens at the anterior part of the trunk, as in *Sagitta bipunctata*. The intestine has two diverticula at its anterior end.

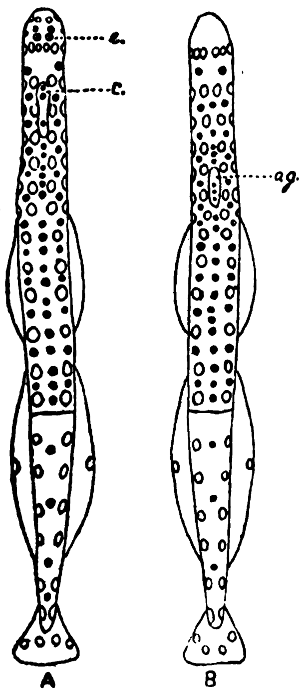
This species is abundant in Misaki throughout the year.

8. *Sagitta regularis*, nov. sp.

(Fig. 8.)

A small-sized species. Larger specimens 7mm. long and 0,5mm. broad. The caudal segment is nearly $^1/_8$ of the whole length of the body. The epidermis is thick throughout the entire body, but especially so in the anterior part of the trunk, so that the head is not constricted from the body as in other species. The muscular layer is very thick. The two pairs of lateral fins are separated, and each fin has the shape of a semi-ellipse. The first fin is short, being nearly half as long as the second fin which lies mainly on the caudal segment. Seizing hooks 7; anterior teeth 2–4, posterior teeth 5–7.

The intestine has two diverticula at its beginning. The mature ovaries may extend nearly to the anterior end of the first lateral fin. The *corona ciliata* is long and elliptic, and is on the trunk segment. The tactile prominences are well developed and regularly arranged.



Wood-cut 1.
e=eye, c=corona ciliata,
ag=abdominal ganglion.

As GRASSI says, there are in all chaetognaths two kinds of tactile prominences: one kind is larger, and the hairs, which are longer than those on the other kind, are arranged in transverse planes, while the second kind is smaller and has shorter hairs arranged in longitudinal planes. These two prominences are arranged in this species regularly in alternate transverse rows except in the dorsal and ventral median lines of the body, where the small prominences of the second kind lie n a longitudinal row at irregular intervals. In the above wood-cut where A shows the dorsal and B the ventral surface,

the tactile prominences of the first kind are shown with clear circles and those of the second with black spots. It may be gathered from the figures that the number of tactile prominences of the first kind in each transverse row, is reduced from 6 in the anterior part of the trunk to 4 in the posterior half, beginning from the level of the first lateral fin. In each transverse row of the prominences of the second kind 4 lie exactly between the prominences of the first kind. It must be noted, however, that the alternation of the rows of prominences of the two kinds are not rigidly carried out, as sometimes two transverse rows of the second kind are placed between the rows of prominences of the first kind. This irregularity commonly occurs in the other species having a similar arrangement of tactile prominences.

In the caudal segment, the tactile prominences are comparatively few; and in the head they are found only on the dorsal surface.

Sagitta bipunctata (small specimens), *Sagitta neglecta*, *Sagitta minima*, *Sagitta serratodentata*, *Krohnia viridis*, *Krohnia foliacea*, and *Spadella draco* have all a more or less similar arrangement of tactile prominences, but none of them shows such a regularity as is found in this species.

9. *Sagitta hispida*, Conant.

(Fig 9.)

Literature: CONANT (5).

Whole length of the body 11mm. that of the caudal segment 2.8mm., and the breadth 0.7mm.

The epidermis thickens at the neck as in *Sagitta bipunctata*. The muscular coat is thick and gives the animal a stout appearance. The two pairs of lateral fins are separated; the first fin is shorter and begins slightly behind the abdominal ganglion (in the young, smaller individuals, it begins at the middle of the abdominal ganglion); the second fin is longer, extending to the spermatic vesicle. The head is comparatively large, and has 7–8 seizing hooks, 11–17 posterior teeth, and 7–8 anterior teeth. Our specimens have a greater number of seizing hooks and

teeth than that described by CONANT. The *corona ciliata* is long, extending anteriorly between the eyes to the base of the brain. It does not reach posteriorly, in our specimens, to the level of the abdominal ganglion, as described by CONANT. The intestine has two diverticula at its beginning. The tactile prominences are very numerous and are arranged somewhat like those of *Sagitta hexaptera.*

10. *Krohnia foliacea,* nov. sp.

(Figs 10 & 16.)

The essential characteristic of this species lies in the possession of a single pair of lateral fins of remarkable size. It extends from before the abdominal ganglion to the middle of the caudal segment, and its breadth is nearly equal to that of the trunk. Along its margin the tactile prominences are arranged symmetrically in both fins at more or less regular intervals. The body is 11mm. long, and the caudal segment nearly $^1/_5$ as long. The epidermis and the muscular coat are thick just as in *Sagitta bipunctata,* comparing individuals of equal size. At the anterior part of the trunk segment there is a thin but well marked transverse muscular layer on the ventral side. The *corona ciliata* is flask-shaped, and lies on the head segment.

Seizing hooks 7, and the single row of teeth, which corresponds to the posterior row in other chaetognaths consists of 5 teeth. The top of the seizing hook is strongly curved inwards (fig 16).

I caught only two specimens of this species in the spring of 1896, and as both were young, with unripe genital organs, I can not give further descriptions.

11. *Krohnia pacifica,* nov. sp.

(Figs. 11, 14, & 15).

This species can be easily distinguished by its faintly yellowish-green epidermis and the ovaries of the same color. One mature

specimen measured 6mm. in length * and 0,33mm. in breadth, and its caudal segment 1.8mm. The head is comparatively small and has 9 seizing hooks and 10–11 teeth arranged in a single row. The row of one side meets at the top of the head with that of the other side (fig 14, *a*). Each seizing hook has a simple termination like that of *Krohnia subtilis* (fig 15). The fins are three ; a single pair of lateral fins extend from before the spermatic vesicle to the level of the anterior end of the ovary, and lies equally on the trunk and caudal segments. The caudal fin is narrow and long, its breadth being nearly one half of its length. It is attached anteriorly to the spermatic vesicle. The *corona ciliata* is elliptic and lies wholly on the trunk segment. The mouth is a transverse slit.

This species greatly resembles *Krohnia subtilis*, but is distinguished by its small head, regular row of teeth, the smaller number of the teeth, and some other characters.

12. *Spadella draco*, (Krohn.)

(Fig 12.)

Literature: LANGERHANS (1), HERTWIG (2), GRASSI (3), STRODTMANN (4).

This is the only species of *Spadella* ever fished in Misaki Harbor. The wide lateral epidermoidal extension of the large vesicular cells, a pair of large tactile prominences, a pair of lateral fins, two rows of teeth, etc. distinguish it from other species.

In conclusion, I wish to tender my thanks to Prof. Dr. K. MITSUKURI for valuable advice and aid.

* Among the chaetognaths from the Bonin Islands, collected by the late Mr. HIROTA, I found one specimen of this species, which differs, however, from those of Misaki in some points. It is a young individual, but its body is 13mm. long. The *corona ciliata* is more elongated posteriorly, like that of *Sagitta neglecta*. The lateral fins extend on the trunk segment nearly one half as much as on the caudal segment.

LITERATURE.

(1). LANGERHANS, P.—Wurmfauna von Madeira III. Zeitschr. für wissensch. Zoologie. Bd.34, p. 132—136. 1880.

(2). HERTWIG, O.—Die Chaetognathen, eine Monographie. Jenaische Zeitschrift für Medicin und Naturwissenschaft, 1880.

(3). GRASSI, B.—I Chetognathi. Anatomia e sistematica con aggiunte embriologiche. Fauna und Flora des Golfes von Neapel. 1883.

(4). STRODTMANN, S.— Die Systematik der Chaetognathen. Archiv für Naturgeschichte, Jahrgang 58, Bd. 1, 1892.

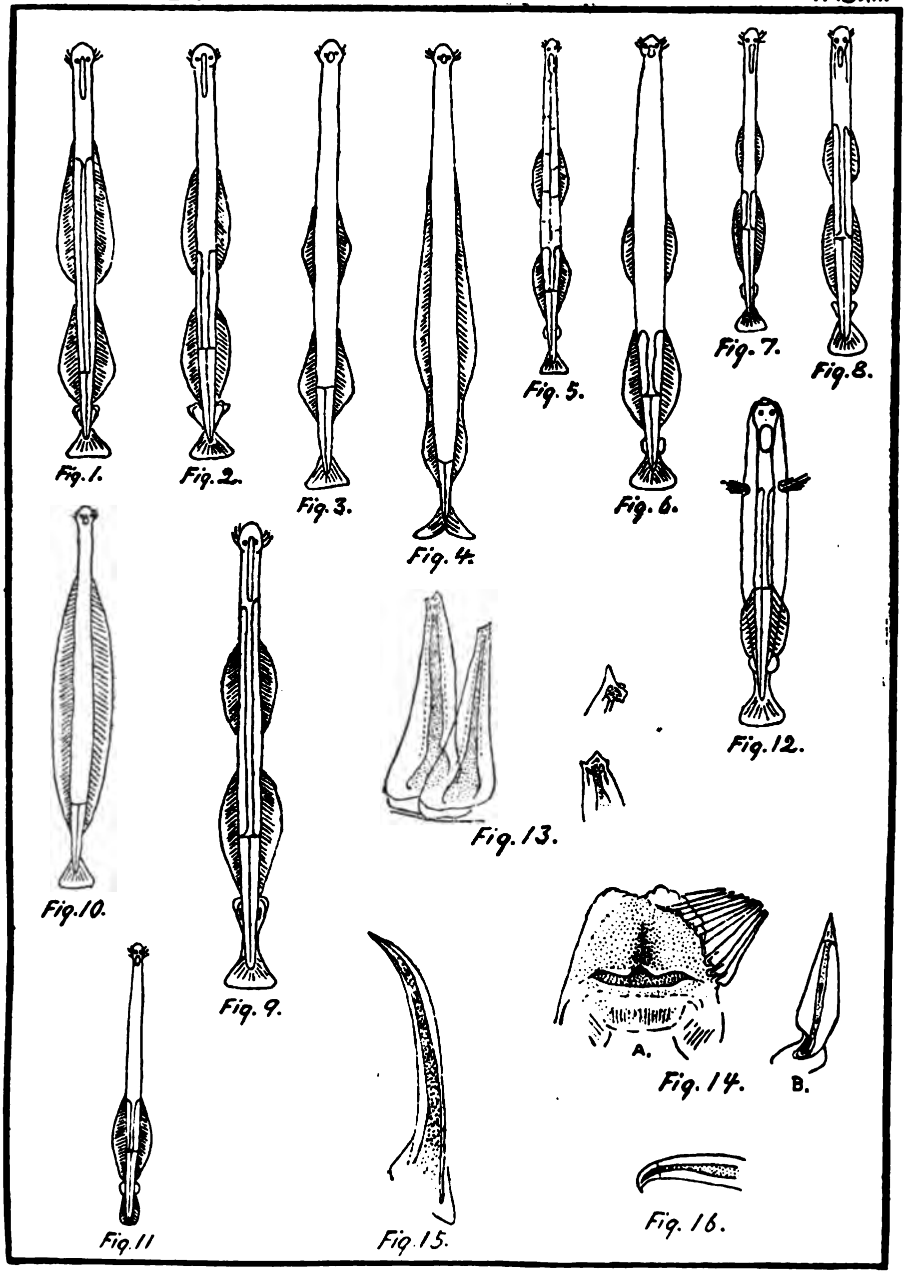
(5). CONANT, F. S.—Description of Two New Chaetognaths. The Johns Hopkins University Circular, no. 119, June, 1895.

(6). CONANT, F. S.—Notes on the Chaetognaths. The Annals and Magazine of Natural History, 6. series, vol. 18, no. 105, 1896.

EXPLANATION OF FIGURES.

Fig. 1. *Sagitta bipunctata.*
2. *Sagitta serratodentata.*
3. *Sagitta hexaptera.*
4. *Sagitta lyra.*
5. *Sagitta minima.*
6. *Sagitta enflata.*
7. *Sagitta neglecta.*
8. *Sagitta regularis.*
9. *Sagitta hispida.*
10. *Krohnia foliacea.*
11. *Krohnia pacifica.*
12. *Spadella draco.*
13. Teeth of *Sagitta serratodentata.*
14. (a) Ventral view of the head of *Krohnia pacifica.* (b) Its teeth.
15. Seizing hook of *Krohnia pacifica.*
16. Top of the seizing hook of *Krohnia foliacea.*

Printed April 30, 1897.



SANKOSHA, ENG., SHINAGAWA

On the Accommodation of Some Infusoria to the Solutions of Certain Substances in Various Concentrations.*

(Preliminary Note.)

By **Atsushi Yasuda.**

Botanical Institute, Science College, Imp. Univ., Tokyo.

Organisms are generally influenced by external circumstances, and when the medium, in which they are found, is changed they, to a certain extent, accommodate themselves to the new one. About this faculty a number of investigators have already contributed to our knowledge many interesting facts, various media and organisms having been submitted to observation.

Among lower plants, STAHL[1] studied the accommodation of some myxomycetes to grape-sugar solutions. KLEBS[2] noted the recovery of fresh-water algæ from the plasmolysis caused by solutions of some chemical substances, and in this way established to some extent their power of adaptation to the new media. RICHTER[3] made some detailed experiments on the accommodation of fresh-water algæ to common-salt solutions. The same result as that found by KLEBS was observed by JANSE[4] with fresh-water and marine algæ, and also by OLTMANNS[5] in

---

* Reprinted, with the author's approval, from the Botanical Magazine, Tokyo, Vol. XI, No. 121, published March 20, 1897.

1) E. STAHL. Zur Biologie der Myxomyceten. Bot. Ztg., 1884. Nr. 10, p. 166.

2) G. KLEBS. Beiträge zur Physiologie der Pflanzenzelle. Berichte der deutsch. bot. Gesellsch., 1887. Bd. V, Heft 5, p. 181.

3) A. RICHTER. Ueber die Anpassung der Süsswasseralgen on Kochsalzlösungen. Flora, 1892, p. 4.

4) J. M. JANSE. Plasmolytische Versuche an Algen. Bot. Centralbl., 1887. Bd. XXXII, p. 21.

5) F. OLTMANNS. Ueber die Bedeutuug der Concentrationsänderung des Meerwassers für das Leben der Algen. Sitzb. d. Königl. preuss. Akad. d. Wissensch. zu Berlin, 1891, p. 193.

the case of marine algæ. ESCHENHAGEN[1] showed the effects of various solutions on the growth of some moulds.

Concerning higher plants, WIBLER observed in one case[2] the recovery of *Vicia Faba* and *Phaseolus multiflorus* from the plasmolysis caused by sugar solutions, while in the other case[3] he noticed the deformation of the roots of the latter plant when put into glycerine solutions. STANGE[4] showed in his "Beziehungen zwischen Substratconcentration, Turgor und Wachsthum bei einigen phanerogamen Pflanzen" the adaptation of *Phaseolus vulgaris, Pisum sativum*, and *Lupinus albus* to plasmolyzing agents. TRUE[5] experimented upon the influence of a sudden change of turgor on the growth of *Vicia Faba.*

In the animal world, SCHMANKEWITSCH[6] came to the conclusion that *Branchipus stagnalis* which lives in fresh-water changes into *Artemia Milhausenii* in brackish water, and then again into *Artemia salina* in salt-water. That the larvæ of sea-urchins are also deformed by various solutions of chemical substances has been shown by the experiments of HERBST.[7]

There is no doubt that infusoria are like other organisms, also influenced by change in the concentration of the substratum, and within a certain limit, a more or less accommodation to the new medium takes

---

1) F. ESCHENHAGEN. Ueber den Einfluss von Lösungen verschiedener Concentration auf das Wachsthum von Schimmelpilzen. Stolp. 1889.

2) A. WIELER. Plasmolytische Versuche mit unverletzten phanerogamen Pflanzen. Berichte der deutsch. bot. Gesellsch., 1887, Bd. V, p. 378.

3) A. WIELER. Ueber Anlage und Ausbildung von Libriformfasern in Abhängigkeit von äusseren Verhältnissen. Bot. Ztg., 1889, Nr. 34, p. 551.

4) B. STANGE. Beziehungen zwischen Substratconcentration, Turgor und Wachsthum bei einigen phanerogamen Pflanzen. Bot. Ztg., 1892, Nr. 18, p. 292 und Nr. 19, p. 307.

5) R. H. TRUE. On the Influence of Sudden Changes of Turgor and of Temperature on Growth. Annals of Botany, 1895, vol. IX, p. 372.

6) W. SCHMANKEWITSCH. Zur Kenntniss des Einflusses der äusseren Lebensbedingungen auf die Organization der Thiere. Zeitschr. f. wiss. Zool., 1877, Bd. XXIX, p. 429.

7) C. HERBST. Experimentelle Untersuchungen über den Einfluss der veränderten chemischen Zusammensetzung des umgebenden Mediums auf die Entwicklung der Thiere. I. Theil. Zeitschr. f. wiss. Zool., 1892, Bd. LV, p. 446.

place. But then, to what extent would they accommodate themselves to that medium? And again, what change is brought about to the bodies of these organisms? COHN[1] observed in his early investigations that a sudden change of the concentration of the medium was injurious or fatal to them. FABRE-DOMERGUE[2] noted that the reserved materials found in the bodies of infusoria appeared and disappeared according as the external conditions might be favourable or unfavourable to them. BOKORNY[3] found certain changes in their bodies when subjected to the action of some basic substances. But a more detailed study on the effects of the changed medium upon them has not yet been made.

I began to investigate this subject from the spring of last year in the Botanical Institute of the Imperial University, and will now make a preliminary note of some of the results of my experiments.

I selected milk-sugar, cane-sugar,[4] grape-sugar, glycerine, and common salt as the external media to be used, while the infusoria *Colpidium colpoda*, *Chilomonas paramæcium*, *Euglena viridis*, *Paramæcium caudatum*, and *Mallomonas sp.* were chosen as bodies for the investigation.

The experiments now described were made by a sudden transfer of the organisms from the normal medium to an abnormal one, those in which gradual change of the concentration of the medium is made being still in course of investigation, and it may be proved to be the case that the degree of accommodation given here is in reality much lower than that when gradual change is made.[5]

---

1) F. COHN. Entwickelungsgeschichte der microscopischen Algen und Pilze. Nova Acta Akad. Cæs. Leopold., 1854, Bd. XXIV, Th. 1, p. 132. (Cited by TRUE.)

2) M. FABRE-DOMERGUE. Recherches anatomiques et physiologiques sur les infusoires ciliés. Annales des sciences naturelles, Zoologie, 1888, 7^me^ série, tome V, p. 135.

3) T. BOKORNY. Einige vergleichende Versuche über das Verhalten von Pflanzen und niederen Thieren gegen basische Stoffe. Pflüger's Archiv für die gesammte Physiologie des Menschen und der Tiere, 1895, p. 557.

4) As our culture of infusoria contained bacteria it was necessary to test how long cane-sugar was recognisable as such in the culture-water. After four days I found, by means of Fehling's solution, that a little inversion of it had taken place.

5) F. ESCHENHAGEN. *loc. cit.* p. 34. Also B. STANGE. *loc. cit.* Nr. 18, p. 293.

The examination of each culture was made at the end of 1–5 days, was repeated several times, and every time carefully compared with the control-culture.

Colpidium colpoda.

In milk-sugar solution the organism was found to survive in 1–10% concentrations. In 1–2% solutions nothing remarkable was observed, but in a 4% solution the vacuoles increased in size and the body enlarged itself and became somewhat rounded. In solutions above 6% the vacuoles greatly enlarged and increased in number, giving the body of the organism an extremely plump appearance.

In the case of cane-sugar the organism survived in 1–8% solutions. In a 3% solution the vacuoles became larger and the body began to be rounded. In solutions above 5% these changes were more noticeable.

In grape-sugar it survived in 1–7% solutions, and behaved much as in the preceding medium.

In glycerineit was found to survive in 1–5% solutions, changes like the last being produced by solutions of 3% and stronger.

In common salt it survived up to ½% solution.

Chilomonas paramæcium.

The organism survived in 1–8% milk-sugar solutions. In a 4% solution the corpuscles became larger and the body increased both in breadth and thickness while it rather decreased in length. In an 8% solution these changes were the most remarkable.

Of the 1–7% cane-sugar solutions in which it could survive, those above 3% produced changes on its body like those caused by milk-sugar. This organism seemed to adapt itself well to 1–6% grape-sugar, 1–4% glycerine, and $\frac{1}{10}$–$\frac{3}{8}$% common salt.

Euglena viridis.

Solutions of 1–17% milk-sugar, 1–13% cane-sugar, 1–11% grape-sugar, 1–5% ? glycerine, and more than 2% common salt were found to

be suitable to the life of this organism. Its body is highly metabolic, so that no distinct change except the enlargement of the corpuscles could be observed.

Paramæcium caudatum.

This organism was found to survive in 1–8% milk-sugar, 1–7% cane-sugar, 1–5% grape-sugar, 1–3% glycerine, and $\frac{1}{10}$–$\frac{3}{8}$% common salt solutions, and experienced changes similar to those observed in the case of *Colpidium colpoda.*

Mallomonas sp.

Solutions of 1–9% milk-sugar, 1–7% cane-sugar, 1–6% grape-sugar, 1–4% glycerine, and $\frac{1}{10}$–$\frac{3}{8}$% common salt were adapted to this organism, and had the usual effects.

In general, when the concentration of the external medium increased, the bodies of the organisms contracted, and then their movements which had hitherto been active became slower and slower until they ceased entirely. In a few hours, however, the contraction of their bodies gradually disappeared and they recovered their normal condition, accommodation to the new medium now beginning to take place. Similarly, FISCHER[1] found that 10–30% cane-sugar, which caused strong plasmolysis on *Spirillum,* stopped its movement. EWART[2] also observed that *Bacterium Termo,* which moved actively in 10% cane-sugar or 5% grape-sugar, lost its activity in 20% cane-sugar or 10% grape-sugar, and finally came to rest in 30% cane-sugar or 20% grape-sugar.

The higher the concentration of the solutions, the more difficult the accommodation of infusoria to them became, and when it took place the vacuoles or the corpuscles in the bodies of the organisms remained

---

1) A. FISCHER. Untersuchungen über Bakterien. Pringsh. Jahrb., 1895, Bd. XXVII, pp. 39—40.

2) A. J. EWART. On Assimilatory Inhibition in Plants. The Journal of the Linnæan Society, 1896, vol. XXXI, no. 217, p. 434.

increased in size as well as in number while their bodies became much thicker, with outlines presenting a more or less rounded appearance.

Of the five external media I used the sugar-solutions proved to be the best adapted to the organisms, the highest degree of adaptation being possessed by milk-sugar, then followed cane-sugar and next grape-sugar. Glycerine was found to be better adapted than common salt.

It is evident that the action of the above substances is not due to the degree of their concentration but to their chemical nature; for the solutions which were in isotonic concentration did not have the same effect upon the organisms. Thus, in the cultures of *Colpidium colpoda*, for example, 8% cane-sugar, which is isotonic with 8.4% milk-sugar, 4.2% grape-sugar, 2.2% glycerine and 0.9% common salt, formed the highest limit, together with 10% milk-sugar, 7% grape-sugar, 5% glycerine and ½% common salt, so that the limits in the latter case were generally found to be far higher than those in the former, except with common salt where, on the contrary, the adaptation of the organism was much lower. A similar observation was made by STANGE,[1] who found that isotonic solutions caused various growth-rates in the bodies of plants.

Conclusions :—

(1) Isotonic solutions of the chemical compounds in question do not produce corresponding effects upon the bodies of infusoria. The action depends more upon the chemical nature of each substance than upon its concentration.

(2) In solutions of higher concentration a contraction of the bodies takes place, which disappears after some hours, when the organisms begin to accommodate themselves to the new media.

(3) Higher concentration of the medium retards the multiplication of the organisms.

(4) As the concentration of the medium increases, the movement of the organisms is retarded.

---

1) B. STANGE. *loc. cit.* Nr. 22, p. 364.

(5) In sugar-solutions of higher concentration some infusoria seem to increase in size, only till a certain limit is reached.

(6) The vacuoles or the corpuscles increase in diameter as the concentration of the medium becomes stronger.

(7) The more the concentration of the medium increases the more rounded become the organisms.

March 1897.

Reprinted May 6, 1897.

On Changes which are found with Advancing Age in the Calcareous Deposits of Stichopus japonicus, Selenka.

By **K. Mitsukuri**, Ph. D.

Professor of Zoology, Imp. Univ., Tokyo.

I am at present engaged in a study of the Holothurioidea of Japan, the results of which I hope to publish elsewhere before long. But the following facts in regard to the calcareous bodies of our commonest holothurian—*Stichopus japonicus*, Selenka,—appear to me remarkable enough to deserve a separate preliminary notice.

The statements made by previous writers about the calcareous bodies of that species do not in many respects agree with one another, and it will be found difficult to obtain from them a clear idea on the matter. This is not to be wondered at, as some most important facts have hitherto been entirely overlooked.

SELENKA who gave the first description of the species (Zeitsch. für wiss. Zool., Bd. XVII, p. 318) had only one specimen 110 mm. long. In regard to the calcareous bodies, he says; "*Die Kalkgebilde bestehen ausschliesslich in 0.05mm. breiten thurmförmigen Körper* (Fig. 34–35), unter denen ich sehr zahlreiche Hemmungsbildungen, nämlich durchbrochene Ringe, finde (Fig. 36)."

Fig. 1

34 35 36

Calcareous bodies of *Stichopus japonicus*. Copied from SELENKA.

VON MARENZELLER who next touched on the subject ("Neue Holothurien von Japan und China," Verhandl. zoolog-bot. Gesellsch. Wien, 1881, p. 137) had several specimens, the largest of which was 70 mm. long and not sexually ripe. He says:— "Die Kalkkörper sind, wie SELENKA angiebt, von den Kalkstäben der

Füsschen abgesehen, nur einerlei Art. Die Fig. 35 (SELENKA, *l. c.*) gibt wohl nur eine Hemmungsbildung wieder, die dadurch entstanden, dass die Stäbchen des Stieles nicht gleichmässig zur Ausbildung kommen, und mit einander vor der Bildung einer Krone verschmelzen. Uebrigens habe ich eine solche Form nie gesehen. Fig. 11*a** stellt eine regelmässe kleine, Fig. 11*b* * eine grosse Scheibe dar. Die Scheibe der Stühlchen misst in Durchmesser nicht leicht unter 0.045 mm. und selten 0.075 mm. Dazwischen alle Grössen. Ich finde den Stiel nicht durchaus so gebildet, wie ihn SELENKA unter Fig. 34 wiedergibt. Er ist hier breit und zeigt nur einen einzigen Querstab unter der Krone, deren Zacken übrigens zu stark nach aussen gebogen scheinen. Neben solchen Stühlchen, an welchen der an der Basis z. B. 0.18 mm. breite und 0.033 mm. hohe Stiel gegen das Ende immer verbreitert ist, finden sich andere noch von gleicher Gestalt, aber mit zwei Querstäben im längeren Stiele, und dann durch Uebergänge verbunden solche, deren Stiel schmal, lang, mit zwei und mehr Querstäben versehen und etwas konisch zulaufend, nicht verbreitert ist. * * * * Ferner kann die Zahl der Stäbchen des Stieles reducirt werden. Ich fand ein Stühlchen mit einem 0.09 mm. langen und 0.015 mm. breiten Stiele, der fünf Quertäbe aufwies, aber aus nur zwei Langsstäben bestand." No mention is made by v. MARENZELLER of the presence of such perforated plates as are given in SELENKA's fig. 36.

THÉEL in his Report on the Challenger Holothurioidea (Reports, vol. XIV) had one specimen of *Stichopus japonicus*, and says: "The specimen does not quite agree with the description of SELENKA and VON MARENZELLER, but nevertheless, I do not think it possible to refer it to any other species. * * * * It is especially with regard to the deposits that disagreements exist, which render the correctness of my determination dubious. The tables have the same shape as described by VON MARENZELLER (Pl. VII., fig. 3, *a*, *b*.) but, besides these, I find a great quantity of small rounded or oval perforated plates (Pl.

* VON MARENZELLER's figs. 11 *a* and *b* are very much like Fig. 2 *a*, *b*, of the present article.

VII, fig. 3, *c*), some of which bear a certain resemblance to buttons. SELENKA also described such bodies under the name of ' Hemmungsbildungen'. "

THÉEL had two other specimens each 220 mm. long which he established into a new variety under the name of *Stichopus japonicus*, var. *typicus*. In regard to the calcareous bodies of these specimens, he found that they consisted of tables alone, but comparatively few of them were fully developed, by far the greater part presenting themselves under the shape of perforated discs with the margin very uneven or spinous, and with no spire or a very poorly developed one. The rare complete tables were smaller and larger, composed of a rounded perforated disc with smooth margin and a spire built up of mostly four rods, with one or more transverse beams, and often terminating in four longer or shorter teeth. There were also found tables with a spire composed of only two rods. It is but just to THÉEL to mention that he makes a distinct statement to the effect that, these specimens may prove to be older and more developed forms of *Stichopus japonicus* than those previously studied.

LAMPERT in his " Die Seewalzen " says : " Stiel der Stühlchen bald mit einer, bald mit zwei Querleisten, in letztem Falle oft mit seitlichen Dornen besetzt; die als durchbrochene Ringe erscheinenden Hemmungsbildungen sehr zahlreich. " He also says " einspitzige Stühlchen wie SELENKA eines abbildet, konnte ich eben so wenig wie v. MARENZELLER auffinden. "

To make the matter still more intricate, the form which SELENKA (*l. c.*) described under the name of *Holothuria armata* and in which he found only sparingly " durchbrochene Plättchen " besides the " Endscheiben, " is considered by THÉEL to be probably nothing else than *Stichopus japonicus* (Challenger Report, Vol. XIV, p. 196).

From these citations, we are able to gather the fact that the calcareous deposits of *Stichopus japonicus* consist of only one kind, viz. tables. But beyond this, it is difficult to obtain any clear ideas. It is most probable that these tables are present in the shape of simple per-

forated plates as "Hemmungsbildungen," but VON MARENZELLER makes no mention of them. As to what the shape of the complete tables is, one will be sorely puzzled to find out. The figures and descriptions given by SELENKA and by LAMPERT will be found difficult to reconcile with those of VON MARENZELLER or of THÉEL. Moreover, while it seems certain that there are forms closely related to *Stichopus japonicus*, such, for instance, as that described by THÉEL as var. *typicus*, or that called by SELENKA *Holothuria*(or *Stichopus* according to THÉEL) *armata*, it is impossible to know exactly in what relation these forms stand to the species proper or to one another.

When I began to examine the specimens of what I supposed to be *Stichopus japonicus* my perplexity was greatly increased. For actual specimens seemed to be about as varied as the descriptions of the above mentioned authors. Individual after individual were found with only perforated plates * and without any complete tables. Or if I succeeded in finding some with complete tables, these latter seemed to show a great variety of forms among themselves, so that it was impossible to specify a shape common to all specimens. Finally, the question seemed to resolve itself into this : Either there are two distinct species among the form known in Japan as the common "*namako*" (hitherto supposed to be identical with *Stichopus japonicus*), one species corresponding to *Holothuria armata* of SELENKA and the other to *Stichopus japonicus* of the same author, or else the species known as *Stichopus japonicus*, Selenka, presents an extraordinary variety of forms in their calcareous deposits. If the former alternative was the case, it was most desirable to establish the fact and to define the limits of each species, for it had a most practical bearing on the question which it had been, and is, my purpose to study, viz. how to protect or cultivate the *namako* for economic purposes. If the latter alternative was the case, it would be of great morphological interest to find out with what conditions, these variations of the calcareous deposits are correlated. To settle the ques-

* Apart from the terminal disc and supporting bodies of the tube-feet and papillæ. Of these, I am not at all speaking in the present article.

tion in either way, the overhauling of a large number of specimens of both sexes, at various stages of growth and from all sorts of localities was a necessity. Fortunately, I had been slowly accumulating just such a collection, in course of the inquiry undertaken with the above-mentioned economic object at the request of the Ministry of Agriculture and Commerce. Moreover, from the experience thus gained, I found it possible to tell within certain limits the age of a given "*namako*" and obtained the knowledge of when and where individuals of certain sizes might be found.* I thus flattered myself that I had favorable opportunities for settling the question put forth above in regard to the calcareous deposits of the "*namako.*"

I shall now briefly set forth the results of my study on this question :—

> The holothurians commonly known in Japan under the name of the "*namako*" all belong to one species, viz.:—*Stichopus japonicus*, Selenka. The form distinguished by THÉEL as var. *typicus* is only a stage in the growth of the species. *Holothuria armata*, Selenka may possibly be better set down as a variety of this species, *not*, indeed, on account of its calcareous deposits but of some other characters——as will become clear in the sequel.
>
> *The form of calcareous bodies* † *changes with advancing age in Stichopus japonicus. The youngest individuals have most perfectly formed, large-sized tables and nothing but these. They have such tables very thickly crowded or even overlapping with their bases. With the growth of the animal, perfectly formed tables decrease both in number and size, and tables in various stages of arrested development are found mixed with them. The degree of imperfection in tables of arrested development as well as the proportion of such tables to perfectly formed ones constantly increase with age,*

* It is my intention to put together elsewhere the results of my inquiry into the habits and life-history of the "*namako*," together with my plan for the propagation of the animal.

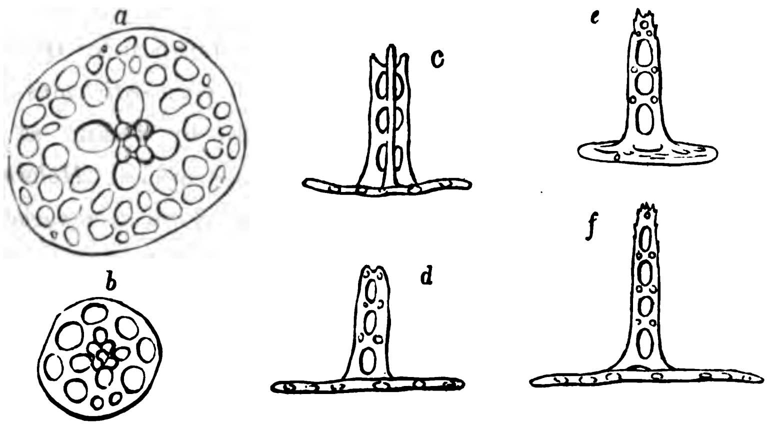
† As before, I am not speaking of the terminal discs and supporting rods of the tube-feet.

until in fully grown individuals, there are found nothing but small perforated plates, representing only a small central part of the basal disc and without any trace of the spire. These are moreover comparatively but thinly scattered in the skin.

As the changes outlined above take place only by degrees, it is not of course possible to fix any well marked stages ; nevertheless as a matter of convenience in describing and identifying various steps in the changes, I have ventured to assort individuals in various stages of growth into five groups as follows :—

Stage I:—Includes the youngest individuals whose calcareous bodies are *all well formed tables.* The preparations* made from specimens

Fig. 2.



respectively 10, 18, 23, 27 and 30mm. long † present a striking appearance. The skin is so thickly crowded with tables that very little space is left between them. These tables (fig. 2) have all a well formed basal disc and a tall slender spire, and are tolerably uniform in size, compared with those found in later stages. The commonest size of the basal disc is about 0.06 mm. but exceptionally large ones may reach 0.11— or even 0.12 mm. when measured along the longer axis of those that

* Made by simply passing a piece of the thin and almost transparent skin through different grades of alcohol, clarifying it in clove-oil and then mounting it in balsam, without any treatment with potash.

† All measurements made in alcoholic specimens, unless otherwise specified.

have an oval disc. Those below 0.06 mm. are comparatively few, at least in the youngest individuals. They all possess a smooth margin. The four pillars of the spire are set very close to one another in the center of the disc. The commonest number of transverse beams are three or four, but exceptionally may become five or two. The pillars often incline towards one another, above the highest transverse beam but one, so that the spire frequently looks as if it were slightly conical or ended in a point. There are minute teeth on the spire, especially near the tip. The height of the spire is generally about 0.06 mm. but may become slightly higher (0.078) or lower (0.048).

In older individuals of this group—*e. g.* in those respectively 39, 40, 46, 50, 60 mm. long—the tables whose disc is less than 0.06 mm. sometimes becoming as small as 0.03 mm. are mixed with larger ones in a greater proportion than in younger individuals. Many of these discs have only eight holes *i. e.* four small holes in addition to, and alternating with, the four large holes at the center. Those with only the four central holes (fig. 3) which are such a prominent feature of later stages are as yet very rare, and even these have a tolerable spire. The height of the spire seems also in many cases somewhat reduced, and those with two transverse beams are of much more frequent occurrence. The tables are also much less closely scattered than heretofore. One individual 70 mm. long I feel justified in placing in this group, for although the features given above for the individuals that are 39–60 mm. long in contrast to younger individuals are brought out still more prominently, nearly all the tables have still some sort of spire, even if the spire has often only one transverse beam, or may consist of only three or two pillars.

We may therefore conclude that young individuals whose lengths are below about 70 mm. possess calcareous bodies which are all well formed tables.

It is evident that the specimens which von Marenzeller examined, belonged to this group, for the largest one in his possession measured 70 mm. This circumstance accounts for the fact that he makes no refer-

ence to those perforated plates or "Hemmungsbildungen" which others mention as an important feature.

Stage II:—In this group, I propose to include those individuals in which those small, perforated plates with or without rudiments of a spire (fig. 3) begin to be a noticeable feature but not to such an extent that they seem to form a larger portion of the calcareous deposits of the animal than the well formed tables. I have fixed a somewhat arbitrary standard and put in this group all those in whose skin I could count at least 7–10 well-built tables (fig. 2) in a field, when examined with Zeiss CC × 3. The tables with 2–3 transverse beams are most frequent. Some with only one beam are seen.

It is impossible to fix any limits in the lengths of individuals belonging to this group with anything like accuracy. Those which I have placed in this group are respectively 50, 50 54, 70, 70, and 110 mm. in lengths.

I believe that the single specimen which THÉEL identified with some hesitation as *Stichopus japonicus*, belongs to this stage. His description tallies well with what I have given above.

Stage III:—This I propose to call the *typicus* stage, for those specimens which THÉEL distinguished as *Stichopus japonicus*, var. *typicus* may be taken as good examples of this stage. Here the calcareous bodies which correspond to the large well formed tables of the preceding stage have begun, many of them, to show various degrees of imperfection. This arresting of development affects both the basal disc and the spire. Thus the spire may become lower, have a smaller number of transverse beams (1–2), and often have the ends of the pillars bent outwards (SELENKA, Fig. 34, or THÉEL, pl. VIII, fig. 2*b*). Or the pillars may be reduced in number to three or two, or be occasionally increased to five (THÉEL, pl. VIII, fig. 2*d*), and often inclined towards one another, especially near the upper end so as to produce a conical shape. Or the spire may be represented by 1–4 simple knobs which are rudiments of the pillars. Or finally there may be no trace of a spire. The complete tables have the margin of their basal disc entirely smooth, but

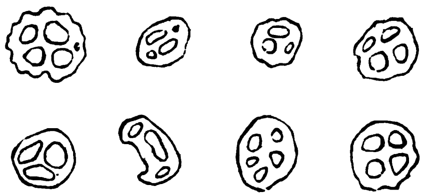
the discs that are affected by the "Hemmungsprozess" have all more or less spinous margin and are reduced in size in various degrees. (See THÉEL, Pl. VIII, Eig. 2*d*.) When no spire is developed a table becomes nothing but irregular perforated plates with spinous margin. The larger ones of this kind graduate by degree into small, perforated plates which we saw in the preceding stage. At this period, therefore, we see three kinds of calcareous deposits: (a) completely built tables such as we saw in Stage I, (b) tables showing various degrees of imperfection and having spinous margin, and (c) perforated plates, mostly with spinous margin which from tolerably large ones shade off into quite small quadriloculate forms.

The specimens which showed best the characteristics of this stage are several individuals 200–250 mm. long (in fresh state), which I obtained at Kanagawa and which I believe, from a series of observations made at the same locality, to be at the end of their first year. There are, however, others which are smaller (175 mm. fresh. Tōkyō market) and larger. THÉEL's specimens measured 220 mm. and must have been considerably larger in fresh state.

Stage IV:—This is the stage in which the original specimen described by SELENKA must have belonged, although it was only 110 mm. in length. The tables of the original form which were characteristic of Stage I, have now all disappeared or, if present, very rare, and only those that show various degrees of imperfection are seen and even these are not very numerous. The spire is mostly very low, having generally only one or at the most two transverse beams, and may be reduced in the number of the pillars. Various forms of asymmetry* may be produced by difference in lengths of the pillars on the same disc, or by the pillars inclining towards and fusing with, one another. SELENKA's Fig. 35 represents without question one of these forms, and I have seen many which are quite near it, although never one which is exactly as symmetrical as the one the figure shows. By far the most prominent feature

* Such forms may also be seen from earlier stages.

Fig. 3.



Some forms of perforated plates. ×300.

of the calcareous deposits in individuals of this stage is the presence of those which SELENKA named "Hemmungsbildungen" (Fig. 3). These show various sizes, but on the whole are smaller than those in the *typicus* stage. On many are seen little knobs which are the rudiments of the pillars of a spire.

It is impossible to give any limits in the lengths of individuals which belong to this stage. Those that I placed here range between 50 mm. (alcoholic specimen) and 210mm. (in fresh state). Probably still larger ones may be placed here.

Stage V:—This I propose to call the *armata* stage, for the specimen which SELENKA named *Holothuria armata*, had calcareous bodies which are typical of this stage. In other words, all forms of tables with a spire have now entirely disappeared. At the most, there are only simple knobs which represent the rudiments of the pillars of a spire. All the calcareous bodies are therefore in the shape of perforated plates or SELENKA'S "Hemmungsbildungen." In the younger ones of this stage, these perforated plates may be still large and have spinous margin, but the older the individual, the smaller and smoother become the calcareous bodies, and the nearer they approach the shape of a ring with *four openings*, representing the four central holes in the discs of the earlier tables. In the very oldest, even these four holes are not complete, and a part of the circumference may often be lacking to the ring. The calcareous deposits are also much more sparsely distributed than in earlier stages.

I need hardly remind the reader that as the above five stages have been artificially marked out in an unbroken series of changes, many an intermediate state of things will be found, which an investigator will find difficult to put precisely in any one of them. I claim for them nothing beyond some advantage that they afford in elucidating the

the process of changes in the calcareous deposits of *Stichopus japonicus.*

It is evident from what has been given above that the calcareous deposits in our species are more complete and show more primitive characters in young stages than in older or adult forms. In the youngest stages examined, they have almost the character of a calcareous coat of armor, similar to that of a starfish or of a sea-urchin. There are undoubtedly physiological reasons for this: the youngest individuals have a very thin and pliable skin and muscle layer so that some sort of protection and support is a necessity. But a possible phylogenetic significance should not be lost sight of.

It will be seen that I agree with THÉEL in regarding *Holothuria armata* of SELENKA to be only a form of *Stichopus japonicus.* My reasons for thinking so are as follows:—I have fortunately some specimens of *Holothuria armata* which Prof. SELENKA kindly identified for us during his stay in Japan. There can be therefore no question as to their being *Holothuria armata.* Now, an examination of the calcareous deposits of these specimens reveals a condition exactly like the fifth stage of *Stichopus japonicus.* I see no reason for separating them from other specimens of *Stichopus japonicus* of the same stage, so far as the calcareous deposits are concerned. Unfortunately, these specimens lack the viscera, and I have not yet had an opportunity of examining the reproductive organs of this type. But my friend, Mr. NOZAWA of the Hokkaido Fisheries Bureau informs me that when he examined some years ago the specimens of that form in order to determine its breeding season, he remembers seeing *two* genital bundles, one on each side of the median mesentery. There is therefore very little doubt in my own mind that the form which SELENKA has signalized as *Holothuria armata* is the northern form of *Stichopus japonicus.* It is easily distinguished by having four rows of many long pointed papillæ along the two dorsal ambulacra and the lateral margins, and by having numerous much smaller papillæ interspersed between these four rows. This form is found in the Hokkaido (Yesso) and the northernmost part of the Honshū (the main Island of Japan). As we go down southward in our country, the

papillæ of *Stichopus japonicus* seem tod ecrease in number as well as in height. This difference becomes so apparent when dried for the market that dealers in dried "namako" divide them into those with spines (papillæ) and those without them. The former is the northern form, while the latter from the southern part, show only a row of low papillæ along the lateral margins and few others scattered over the dorsal surface. Those from Tokyo and the vicinity seem to be intermediate between the two. I think that if the form found in the central part is taken as the type of the species, the northern form with many papillæ might be distinguished as *var. armatus,* while the southern form with few papillae might be called *var. australis.* Of course, these pass into one another insensibly. And even at one and the same locality, there seems to be a great deal of difference in different individuals in this respect. I am inclined to think that the habitat of the animal has a great deal to do with the matter. Those that live among rocks along a rocky beach seem to be distinguished by a larger number of tall papillæ as well as by a mottled brown color, while those that live on sandy ground, probably among sea-weeds, have lower and fewer papillæ and have generally a dark green color. So that it seems possible to me to divide the species into varieties by latitude and by habitat.

It would be a singular fact, if the changes in the shape of the calcareous deposits brought out above in *Stichopus japonicus* should turn out tobe the solitary case of such an occurrence among the order of Holothurioidea. I am rather inclined to think that if carefully studied, every species will present more or less similar changes. If this should turn out to be the case, I need hardly point out what an important bearing it has on the systematic classification of the species of holothurioidea. At any rate, those who collect holothurians should bear the fact in mind and endeavor to obtain a large number of individuals in varios stages of growth from different localities.

Science College, Imp., Univ., Tokyo.

Printed May 16, 1897.

Revision of Hexactinellids with Disc-octasters, with Descriptions of Five New Species.

By Prof. I. Ijima, Ph. D.

Zoological Institute, Science College, Imp. Univ., Tokyo.

The discoctasters are, as enunciated by F. E. SCHULZE,* strongly modified discohexasters in which the six principals have entirely or almost entirely atrophied while the terminals have undergone a new arrangement into eight secondary principals and terminal tufts at points of the central node corresponding to the eight corners of a cube. This peculiar kind of spicules have hitherto been known to occur in the following four species of *Rossellidæ*, viz. *Acanthascus cactus*, F. E. S., *Rhabdocalyptus mollis*, F. E. S., *Rh. Roeperi*, F. E. S. and *Rh. Dowlingi*, L. M. Lambe. To this list, I will add five more species, making in all nine discoctasterophorous species.

Before entering into diagnostic descriptions and systematic arrangement of these species, I hold it essential to make, once for all, some general notes on their structure.

They are all moderately thick-walled, barrel-like, cup-like, or vase-like forms with a deep gastral cavity. Frequently the body shows lateral compression after it has attained a certain size. The simple osculum is situated at the upper end. The thin oscular margin is at first turned inwards, but becomes later directed upwards or outwardly expanded. Attachment to the substratum takes place by an irregular space at the blind end, which region may be contracted in a stalk-like manner but is never solid. When the sponge grows on an inclined or vertical substratum, it commonly happens that the basal region is bent so as to direct the rest of the body upwards.

---

* Sitz-ber. d. kgl. Preuss. Akad. d. Wiss., XLVI, 1893.

The power of opening secondary osculæ or of budding out daughter persons seems to be widely spread, although neither of them are ever formed in any great number. A daughter person first arises as a cœcum-like outbulging of the wall, eventually to open an osculum at the summit.

The principal parenchymalia are exclusively long diactins of well-known nature and arrangement. The intermedia are always of three kinds : discoctasters, oxyhexasters, and microdiscohexasters.

With respect to discoctasters, it is to be noted that the central node contains a typical triaxial cross, which seems not to have been observed before in this kind of hexactinellidan spicule. It is made plainly visible when examined in glycerine or in any other medium of similar refractive power. The six points of the cross are turned towards the middle of the protuberant or otherwise somewhat concave space surrounded by every four secondary principals. The terminals are always, though often obsoletely, rough. The minute terminal discs are either simply shaped like pin-head or toothed at the margin. It frequently happens that deeply situated discoctasters are considerably larger than those in the periphery.

The oxyhexasters, which are the most abundant of all parenchymal intermedia, have very short and sometimes almost entirely atrophied principals. The terminals are smooth or more frequently rough. The roughness may develop at their basal parts into prickles with centrally turned points. Not unfrequently the oxyhexasters situated near the dermal surface differ from those more deeply situated in having longer principals and more slender and more numerous terminals, although they seem to be connected by transitional forms. The most usual number of terminals to a principal is two, and it very frequently happens in such a bifurcated ray that one of the terminals is but very little developed or entirely absent. Thus I have seen cases in which a small rudimentary and a normally developed terminal stood together on a principal. Then there are cases to be met with often enough, in which a single terminal is joined to a principal by its crooked basal end. The

crook just mentioned is, in other cases, modified into a gentle bend and in still others, completely straightened out so that now a principal and a terminal jut out from the central node in a single straight ray. But such a ray ought certainly not to be looked in the same light as the primary undivided ray of a hexactin. The latter is invariably traversed throughout its whole length by the axial canal, which, in the case of hexasters, is likewise found in the principals but never extends into the terminals. In conformity with the last mentioned fact, the apparently simple and unforked hexaster rays already referred to, contain the axial canal only at their bases, clearly demonstrating their constitution out of a principal and of a single terminal. As is well known, one or more rays in an oxyhexaster may be unforked or uniterminal; and when all are so and straight, as is of common occurrence, there arises a form which is in shape a hexatin though not a genuine one in nature. Such a spicule, when cleaned and examined in glycerine, will be found to contain the usual central axial cross, the arms of which extend but for a short distance into the bases of the six rays. The impropriety of simply calling it *oxyhexactin*, as has hitherto been the custom (SCHULZE, LAMBE, RAUF), is evident. It should be called hexactin-shaped oxyhexaster.

The microdiscohexasters are probably never absent, although in some species they occur quite sparingly. They are of usual shape and vary in diameter from 15μ to 26.6μ.

The autodermalia are rough, straight diactins, stauractins, or pentactins, one or the other of these predominating according to species. Monactins, orthodiactins, and triactins are only of occasional occurrence. As in all other Rossellids, a distally directed ray is never developed on the autodermalia. When stauractins or pentactins constitute the main elements, their cruciate rays are usually so arranged as to bring about an autodermal lattice-work with more or less regularly quadrate meshes; whereas, in species with diactin autodermals, the meshes formed are triangular, trapezoidal, or irregular in shape.

A hypodermal system of spicules is always present. For *Acanthascus cactus* it is characteristic that the hypodermalia consist exclusively

of diactins which are grouped in thin anastomosing strands. In the rest of octasterophorous species, they consist of moderately large oxypentactins, either solely or in union with subtangentially disposed diactins. The proximally directed shafts of these hypodermal pentactins are always smooth; the four paratangential rays are also smooth or minutely rough (*Staurocalyptus*), or else armed with biserially arranged, strong, hook-like prongs (*Rhabdocalyptus*). The paratangentials are often, though not always, paratropal, i.e. the four rays are, as it were, pushed aside so that they form with one another three more or less acute angles and one wide angle greater than 90° or even 180°. Similar hypodermal pentactins have long been known in *Rossella antarctica*. As in this species they are generally found in groups of several together. In every such group, proximally directed shafts, accompanied with slender comital diactins, form a more or less compact column or tuft that dips deeply into the parenchymal mass, while the heads composed of paratangential rays bring about a star-like figure, in which a number of streaks radiate in all directions from what I will call, for the sake of convenience, the hypodermal centre. It is easy to discover that the pentactin-heads in a hypodermal group lie one above the other and that the one in an upper situation is older and more fully developed than that following next below. The lowest is therefore the youngest, which developes itself clasping with one of its angles the column of shafts belonging to older pentactins. It is this preëxisting shaft-column that disturbs the regularly cruciate development of the head of young pentactins; hence the paratropal arrangement of paratangential rays.

The hypodermal pentactins remain in their *locus nascendi* only in certain species. More usually they are destined to be protruded outwards through the autodermal layer as prostalia pleuralia. These stand out isolated or in tufts from hypodermal centres; and, in case they are not shed off, their paratangential rays form a gossamer-like veil at a certain distance from the dermal surface, exactly as is known in the genus *Rossella*.

Diactin prostalia are also of common occurrence. These are to be

considered as specially developed parenchymalia. In many species of *Rhabdocalyptus* and *Staurocalyptus* I have found that in very young individuals the needle-like diactin-prostalia project from all parts of the body, but with growth of body, become restricted to the oscular margin, where they may form an ill-defined, often interrupted fringe.

The autogastralia are as a rule rough hexactins with some exceptions. They may be represented by pentactins or by both pentactins and stauractins. The autogastral pentactins has its unpaired ray always distally turned. In one noteworthy case (*Staurocalyptus pleorhaphides*), the autogastrals are to be considered either as being not at all developed or as being represented by short diactins that are not sharply differentiated from parenchymal elements. When autogastralia with cruciate paratangential rays are present in large numbers, they form a continuous lattice-work with small quadrate meshes, covering over the apertures of efferent canals. But when sparingly developed, there are left in the autogastral layer wide gaps, by means of which the efferent canals stand in direct communication with the gastral chamber.

Hypogastral strands are usually more or less distinctly present. They are nothing else than certain strands of parenchymal diactins, that have dissociated themselves in variable degrees from the parenchymal mass and have entered into the support of the autogastral layer.

Finally with respect to dictyobasalia—by which name I designate the thin reticular plate that invariably cover the surface of basal attachment,—I believe that it is formed mainly by direct as well as synapticular fusion of special spicules developed by the stimulus of foreign bodies in contact with the sponge. Where the plate is thin, the axial canal contained in the nodes of beams has the shape of a simple cross, showing that stauractins here lie as the structural basis. On the other hand, where the plate is of certain thickness, the axial canals contained are six-armed and even stout-rayed hexactins themselves are often discernible in the process of fusing with the dictyobasal beams.

The nine discoctasterophorous species, known to me at present, undoubtedly constitute a coherent group separated by a gap of not incon-

siderable extent from allied Rossellids in which the characteristic discoctaster is represented by typical discohexasters. Probably the group deserves to receive the rank of a sub-family, but I prefer to put off this question until I have studied all my Rosselid materials. As will be seen in the sequel I have distributed the species in question under three genera. One of these, *Acanthascus*, although represented by a single species, seems to me to be sufficiently distinct. With respect to the rest, I must say that it would largely depend upon the individual caprice of systematists whether to keep them on as two distinct genera, as I have done, or to make only a subgeneric distinction between them.

Genus ACANTHASCUS.

Discoctasterophorous Rossellids with exclusively diactin hypodermalia.

This genus as originally established by F. E. Schulze in the Challenger Report, included besides the species given below, two more forms that were called *A. grossularia* and *A. dubius*. These latter do not possess discoctasters, which seem to be represented here by discohexasters. On this account and from considerations of certain other points, it seems to me justifiable to remove them altogether from the genus. I think they might be included among *Rossella* more naturally than be left in union with a discoctasterophorous species. Prof. Schulze himself has declared, in his letter to me, to share in this idea now. So then, the genus *Acanthascus* remains with the following single species.

1. *Acanthascus cactus*, F. E. Sch.

Cup-like, vase-like, or funnel-shaped, often somewhat compressed, with simple oscular edge ; dermal surface with conical elevations, bearing on their apex a tuft of strong, needle-like, prostal oxydiactins. The body may attain a large size of more than 450 mm. in height. It frequently bears a limited number of secondary persons.

Parenchymal diactins small, probably never exceeding 15mm. in length.

Discoctasters with 3–6 straight or almost straight, minutely rough terminals on each principal. Length of entire rays (measured from centre) 53–130μ; those found in deep parts being often twice as large as those lying near the dermal layer. In larger discoctasters the principals are also rough-surfaced and the terminal discs 7–8 toothed.

Oxyhexasters 45–76μ in radius. Principals exceedingly short or almost entirely absent. Terminals rough, straight, stout; usually two to each principal, but very frequently reduced to one, so that there occur oxyhexasters with 11, 10, 9, 8, 7 or even 6 points. In the last case they may be typically hexactin-shaped though only in external appearance. The principal is rarely supplied with three terminals.

Microdiscohexasters of usual shape are of frequent occurrence especially in the dermal and gastral membranes.

Autodermalia are predominatingly rough stauractins forming a fine lattice-work with quadrate meshes. This layer is supported by rather thin strands of hypodermal diactins, forming a network of triangular, trapezoidal, or irregular meshes, whose sides rarely exceed 2 mm. in length.

Autogastralia are mainly rough pentactins. These do not form by themselves a continuous autogastral lattice-work but are found scattered on hypogastral strands together with discoctasters and oxyhexasters.

This species, known only from Sagami Sea, is one of the most abundant Hexactinellids of that locality in depths of over 200 fathoms.

GENUS RHABDOCALYPTUS.

Discoctasterophorous Rossellids with pentactin hypodermalia, the paratangential rays of which are, when fully developed, armed with biserially arranged hook-like prongs.

When F. E. SCHULZE instituted this genus for the first time in the Challenger Report, two species were described by him, viz. *Rh. mollis* and *Rh. Roeperi*. Later L. M. LAMBE* described a third species,

* Trans. Roy. Soc. Canada. Sect. IV, 1893. p. 37.

Rh. Dowlingi. Of these three species, only one, i. e. *mollis*, is retainable in the present genus as defined above, while I will now add to it two new species.

2. *Rhabdocalyptus mollis*, F. E. Sch.

Cup-like or vase-like, laterally compressed, contracted below, bearing one or more tube-like secondary persons. The body may attain a height of more than one foot.

Parenchymal diactins short, not exceeding 20 mm. in length. Discoctasters especially abundant in the subdermal region; ray-length (measured from centre) 65–88μ; terminals 5–9 to a principal, rarely as few as 2, straight or only slightly bent outwards; terminal disc 7–8 toothed or simply pin-head like.

Oxyhexasters 51–80μ in radius. Two varieties are distinguishable. Those situated in deeper parts have usually two-forked rays, the principals being very short and often obsolete; terminals smooth or minutely rough, but always with more or less well developed basal barbs. Frequently there is only one terminal to a principal, and hexactin-shaped oxyhexasters are of common occurrence. Oxyhexasters found in the subdermal region have longer principals and bear 2–4 usually 3 rough terminals which are thinner and supplied with less prominent basal barbs. Oxyhexasters with spirally twisted rays are not of constant occurrence.

Microdiscohexasters of usual shape occur in variable numbers, especially in or near the dermal membrane.

Autodermalia are predominatingly rough diactins. Hypodermalia consist of pentactins, pronged in fully developed state, and of smooth diactins. The former have either paratropal or regularly cruciate heads, and in places protected from external influence, may stand out isolated as prostalia. Such a pentactin has paratangential rays not exceeding 5 mm. and a radial ray of not over 10 mm. in length.

Autogastralia are rough hexactins with bluntly conical ends, form-

ing a continuous lattice-work with quadrate meshes. The free proximal rays do not differ in character from the rest.

Locality: Sagami Sea. I have myself collected some specimens from depths of 274 fathoms and upward.

3. *Rhabdocalyptus capillatus*, n. sp.

Sac-like or vase-like, more or less strongly compressed. Oscular edge fringed with thin needle-like prostals, not outwardly expanded. Dermal surface thickly beset with pentactin prostalia which stand out in tufts from every hypodermal centre and form a thick tolerably firm gossamer-like layer all over the surface. The body may attain a height of 210 mm.

Parenchymalia may contain bow-like diactins of 24 mm. in length. Discoctasters are very small, measuring only 38–55μ in radius, and are of very characteristic shape. From a principal there arise 6–12 slender terminals, which are always bent in an S-like manner and form a bunch considerably expanded at the extremity. Terminal discs pin-head like. Discoctasters are most numerously found in the gastral layer.

Oxyhexasters and microdiscohexasters as in *Rh. mollis*, but the former have no or but little developed basal barbs. Hexactin-shaped oxyhexasters are rare.

Autodermalia likewise as in foregoing species. Hypodermalia consist solely of paratropal pentactins, which are grouped in closely concentrated centres. The older and pronged ones destined to be protruded as pleural prostalia, have paratangential rays that may reach 12 mm. in length and a still longer shaft.

Autogastralia, forming a continuous quadrate mesh-work, consist of rough hexactins with pointed ends, the free proximal ray being longer and supplied with better developed microspines than all the rest of their rays.

Notwithstanding the close similarity of spicules, this species is easily distinguishable from *Rh. mollis* by the smaller size and characteristic shape of discoctasters, by the larger size and the persistence of pentactin prostalia, etc.

Locality : Sagami Sea, from depths between 274 and 313 fathoms.

4. *Rhabdocalyptus victor*, n. sp.

Vase-like ; laterally compressed especially at basal part, which is usually bent ; sometimes with one or two secondary persons on the greater curvature of the basal region. Oscular edge simple or with an interrupted fringe of thin diactin prostals. The body may attain a large size, almost 3 feet high.

Parenchymalia may contain stout bow-shaped diactins, 28 mm. long and 0.4 mm. broad at middle. Discoctasters 90–120μ in radius ; terminals 4–8 in a tuft, straight or slightly bent outwards ; terminal discs pin-head like.

Oxyhexasters 90–140μ in radius. Principals exceedingly short or obsolete, usually two-forked. Terminals rough, which character changes towards base into small, inwardly directed prickles. Oxyhexasters with two terminals to every principal occur less frequently than those in which one or more principals bear only one terminal. Hexactin-shaped oxyhexasters are of frequent occurrence.

Microdiscohexasters of usual shape and size are of very isolated occurrence.

Autodermalia consist predominatingly of rough stauractins. Hypodermalia as in foregoing species, but somewhat smaller (paratangential rays 5–7mm. long). Unlike that species, the protruded hypodermal pentactins seem to be readily thrown off, leaving at every hypodermal centre a little bunch of the external ends of comital spicules, that accompanied the lost shafts, projected beyond the otherwise smooth surface. In this respect, the present species agrees with *Rh. mollis*.

Autogastralia as in *Rh. mollis*.

Locality : Sagami Sea, in depths of over 274 fathoms. Next to *Acanthascus cactus*, the present species is apparently the most abundant octasterophorous Hexactinellid in the locality just mentioned.

GENUS STAUROCALYPTUS, n. gen.

Discoctasterophorous Rossellids with pentactin hypodermalia, the paratangential rays of which never possess hook-like prongs, but are either smooth or minutely and uniformly rough.

To this new genus I should refer F. E. SCHULZE's *Rhabdocalyptus Roeperi* and L. M. LAMBE's *Rh. Dowlingi* besides 3 new species to be soon described.

5. *Staurocalyptus Dowlingi* (L. M. Lambe).

With some hesitation I consider certain specimens of *Staurocalyptus* from Sagami Sea as identical with this species first described by LAMBE (*loc. cit.*) from a specimen taken in the Strait of Georgia, Vancouver Island, at a depth of about 40 fathoms. From Sagami Sea, I have several, mostly fragmental specimens obtained at depths of over 235 fathoms. On these is based the following description.

Body subcylindrical or vase-like. It may grow to a considerable size about a foot in diameter. Oscular edge turned upwards or in fully developed state reflected outwards in flaps; simple and smooth or with more or less needle-like prostals. External surface of smaller specimens with a veil produced by the heads of prostal pentactins and also with a number of long diactin prostals standing out in isolated positions. After a certain stage of growth, both of these prostalia pleuralia seem to be lost, except pentactin prostals in positions protected from abrading influences. What constitutes one of the special characters of this species, is the spiny nature of the gastral surface caused by numerous needle-like (parenchymal) diactins that project their ends beyond the gastral surface. In the specimens examined by LAMBE, these gastral prostals seem to have been wanting.

Principal parenchymalia are bow-shaped and in large specimens may measure 35 mm. in length, but their dimension is, as in other species, variable according to the size of individuals.

Discoctasters with radius of 72–145μ or more, those deeply situated

being generally much larger than and often almost or fully twice as large as, those situated in the subdermal space. Terminals 2–8, usually 4–6, nearly straight, forming a slightly diverging tuft. Discs minute and pin-head like or with toothed margin.

Oxyhexasters vary in radius from 38μ to 80μ according to individuals. When changed into hexactin-shape, the radius may measure as much as 110μ. Principals exceedingly short or obsolete. Terminals 2–3, more usually 2, and often only one to a principal, hexactin-shaped oxyhexasters being of common or even abundant occurrence. Surface of terminals either smooth or rough, in which latter case the roughness may develop into small basal barbs. In some specimens only rough hexasters are found; in others both rough and smooth ones occur, and then the latter are generally situated in deeper parts than the former.

Microdiscohexasters present in sparing numbers near the dermal or gastral surface.

Autodermalia consist almost exclusively of rough pentactins with rays 165μ long and 8μ broad in average.

Hypodermal pentactins comparatively small, usually not exceeding 4 mm. in length of paratangential rays (sometimes larger). The latter are either regularly cruciate or paratropal, according to their occurrence in isolated position or in groups. Their surface is smooth, but when fully developed, may become uniformly and thickly beset all over with exceedingly minute protuberances, exactly as I have observed in *Staurocalyptus pleorhaphides*, Ij. or in *Rossella longispina*, Ij. Judged from the series of specimens in my hand, it seems not improbable that the power of giving the above mentioned roughness to the heads of hypodermal pentactins is possessed by the present species only in young state, losing that power after a certain stage of growth. So that the oldest hypodermally situated pentactins as also all the prostal pentactins may be rough-headed in small, but smooth-headed in large, individuals, since in the latter all the rough-headed pentactins would have been shed off during growth.

In forming the hypodermal strands, the paratangential rays of the

above-mentioned pentactins are supplemented by short smooth diactins with or without annular swelling at centre.

Autogastralia are almost exclusively rough hexactins of approximately same dimensions as autodermalia. They are never present in sufficient numbers as to form a continuous lattice-work. The gastral layer therefore possesses gaps of small but variable size, bounded by beams consisting of hypogastral diactins, intermedial rosettes and autogastralia, similarly as in *Acanthascus cactus.*

6. *Staurocalyptus Roeperi* (F. E. Sch.)

This species is based on two specimens obtained by "Challenger" to the south of Puerta Bueno in Patagonia. It is not represented in Sagami Sea and is directly known to me only through two slide-preparations kindly sent to me by Prof. SCHULZE.

The body should be sac-like or cup-like with sharp, smooth oscular edge. The subdermal space, as seen through the even lattice-work of the dermal membrane, should form irregularly scattered, elongated, angular or spindle-shaped pits, whence arise rather narrow afferent canals. On the inner surface round sharply contoured depressions of various sizes occur, into the bottom of which the more or less wide efferent canals open.

Spiculation closely similar to that of foregoing species; but differing in having much more slender rays to intermedial rosettes, dermalia and gastralia; in the sparing quantity of prickles on dermalia and gastralia; etc.

Discoctasters with radius of 65–83μ, without appreciable difference in size according to position. Principals slender, not exceeding 4μ in breadth; with 2–5 nearly straight, slightly diverging terminals with minute, pin-head like discs.

Oxyhexasters very slender rayed; 44–65μ in radius, those near the dermal surface being in general slightly smaller than those more deeply situated. Principals short, often exceedingly short, bearing 2–3 straight or wavy, obsoletely rough terminals. Cases of uniterminal principals

present; hexactin-shaped oxyhexasters probably not absent. It frequently happens that in a dilophous ray, a third terminal is represented by a spurious rudiment.

Microdiscohexasters of usual structure found in tolerable abundance in the subgastral region.

Autodermalia are predominatingly pentactins, but stauractins are by no means unfrequent. Occasionally triactins and diactins, rarely monactins. Rays sparingly rough, not always quite straight; 110–155μ long; usually less than 5μ in breadth at middle.

Hypodermal strands contain besides numerous slender diactins with tuberculated centre, medium-sized pentactins whose slender rays are smooth except at roughened ends. Head of pentactins not paratropal. It is not known whether these pentactins are ever extruded beyond the external surface.

Autogastralia are oxyhexactins with sparingly rough rays of about the same thickness as the autodermalia. Free proximal rays as long as 230μ; other rays somewhat shorter. According to SCHULZE, the autogastralia line the gastral surface as also the surface of the wide efferent canals.

7. *Staurocalyptus heteractinus*, n. sp.

This species is founded on a single bean-sized specimen from Sagami Sea. It represents a strongly compressed pouch with a small simple-edged osculum on one side of the upper end. Texture as in other species; without prostalia pleuralia of any sort.

Discoctasters especially common near the gastral surface. Radius 55–100μ. Terminals 2–7 to a principal; straight, diverging. Disc minute and pin-head like.

Oxyhexasters 53–57μ in radius. Most of those situated in deeper parts have two-forked rays with excessively short principals; terminals stout, straight, rough with minute prickles, which are more prominent and inwardly turned near base. Peripherally situated oxyhexasters have somwhat longer principals, each with 2–4, usually 3, rough-surfaced,

slender and straight terminals. Cases of a uniterminal principal have not been met with.

Microdiscohexasters of usual structure found scattered in the parenchyma.

Autodermalia consist mostly of faintly rough stauractins of variable size, with occasional pentactins and triactins, rarely with diactins. Some of these autodermalia are twice or even thrice as large as others. Radius 90–270μ; rays 9–13μ thick near centre. Ends of rays rounded or even clubbed. Autodermal meshes irregular, not rectangular.

Hypodermalia consist of irregularly distributed pentactins, with occasional stauractins and triactins. Paratangential rays under $^1/_2$ mm. in length; smooth, but often sparingly rough near the conically pointed end; not paratropal.

Autogastralia include faintly rough pentactins and stauractins, more rarely triactins and diactins. Ray-length 55–100μ; thickness near centre 6.5μ in average. They are not present in large numbers.

8. *Staurocalyptus glaber*, n. sp.

Goblet-like or vase-like; laterally compressed; thick-walled. Texture loose and light-looking. In young state with long diactin pleural prostalia; with age these become entirely lost or confined to oscular margin. Prostal pentactins not found. The body may attain a height of 250 mm. Several specimens from Sagami Sea.

Principal parenchymalia more or less bent in bow-like manner; not over 13 mm. in length.

Discoctasters especially abundant in subgastral region; very large, having radius of 250–330μ, although smaller ones are not wanting. Terminals 5–6 to each principal, nearly straight, slightly diverging; discs pin-head like.

Oxyhexasters 49–57μ in radius. Principals short but usually distinct; each with 2–4, usually 3, very slender terminals, which are faintly rough near base.

Microdiscohexasters occur not uncommonly in the dermal, less frequently in the gastral, membrane.

Autodermalia are almost exclusively stauractins with rough or prickly surface, the prickles on the external side being unusually well-developed.

Hypodermalia consist of filamentous diactins and of moderately sized pentactins with cruciate or paratropal heads. Paratangential rays of the latter smooth but with rough ends. These are, I think, never protruded beyond the dermal surface.

Autogastralia consist of comparatively large prickly hexactins, of whose rays the free proximal ray is the longest (450–560μ). They form a continuous lattice-work with quadrate meshes.

9. *Staurocalyptus pleorhaphides*, n. sp.

Thick-walled sac of about the shape and size of a small pear. Oscular edge sharp and simple. The surface shows a number of low hillock-like elevations from the apex of which long diactin prostalia stand out in loose bunches. The body is moreover covered by a veil of pentactin prostalia. Two specimens from Sagami Sea.

Principal parenchymalia, straight or bow-like; not over 8 mm. in length.

Discoctasters with rays 70–98μ long; each principal with 2–4, usually 3, diverging terminals, which are straight or slightly bent outwards. Discs minute, pin-head like.

Oxyhexasters with radius of 57μ in average. Principals extremely short; each with two, seldom more, rough-surfaced terminals. Frequently one or more principals in an oxyhexaster are uniterminal, although hexactin-shaped forms seem to occur but very rarely.

Microdiscohexasters present in sparing numbers.

Autodermalia are predominatingly rough diactins. Hypodermalia consist of a few diactins and of numerous pentactins, whose heads are either regularly cruciate or paratropal. Paratangential rays 5 mm. or

more in length; smooth, but when fully developed, minutely and uniformly rough as in *St. Dowlingi.*

Gastralia are represented by diactins, some of which are similar to autodermalia, while others are larger and very sparingly rough and graduate over to parenchymal diactins.

More detailed descriptions with illustrations of all the above species will be embodied in my monograph on the Hexactinellids of Sagami Sea, which will be published in the Science College Journal.

Printed May 17, 1897.

Miscellaneous Notes.

Ueber eine in Misaki vorkommende Art von Ephelota und über ihre Sporenbildung, von **C. Ishikawa.** Journal of the College of Science, Imperial University, Tokyo. Vol. X, Part II, 1896, S. 119–137. Taf. XII–XIII.—Diese in Misaki von mir in grosser Zahl auf dem Sargassum beobachtete Art von Ephelota sieht, von den Seiten angesehen, einem etwas plattgedrückten Hexagon gleich, und stimmt in vielen Beziehungen mit der von R. HERTWIG zuerst entdeckten Ephelota (Podophrya) gemmipara überein. Sie ist aber in vielen wichtigen Puncten von dieser Art leicht zu unterscheiden, und zwar in dem Bau des erwachsenen Thieres sowohl, wie in der Sporenbildung.

Bei dem Bau des Thieres kommen vor Allem die Tentakeln in Betracht. Diese lassen sich in fünf Gruppen eintheilen, die von bestimmten Körperregionen entspringen. 1) Eine Reihe von sehr langen Greiftentakeln mit breiter Basis steht am oberen Rand des Körpers; 2) eine zweite Reihe von Greiftentakeln, aber ohne die verbreiterte Basis, an dem mittleren Theil des Körpers; 3) eine dritte Reihe von kleinen Tentakeln am Basalende des Körpers um den Stiel; 4) ein Kranz einer Saugtentakelngruppe innerhalb der ersten Tentakelnreihe; und 5) kleinere vereinzelte Tentakeln zwischen den anderen. Von besonderem Interesse dürfte die Thatsache gelten, *dass in allen diesen Tentakeln Fadenstrukturen zu beobachten sind, die mit Eisenhæmatoxylin sich sehr stark und deutlich färben lassen.* Diese Tentakelstrukturen bestehen in den beiden grossen Greiftentakeln aus vier parallel laufenden Streifen, welche senkrecht zur Horizontalebene des Körpers stehen. Jeder dieser vier Streifen ist wieder aus zweien zusammengesetzt. Einige Aehnlichkeit besitzen diese Strukturen mit den neuerdings von S. R. BERGH in der Zellsubstanz zweier Infusorien, Spathidium spatulae und Holophrya Emmae beobachteten "Stutzfasern," lassen

sich aber in beiden Fällen soweit von einander unterscheiden, dass diese Fadenstrukturen in unserem Thierchen stark contractil sind, was in den BERGH'schen Infusorien nicht der Fall ist.

Der grosse Nucleus, den ich mit BÜTSCHLI als Macronucleus anzunehmen geneigt bin, zeigt keine besonderen Eigenthümlichkeiten. Er ist wie in Ephelota gemmipara stark verzweigt. Einige Micronucleus-ähnliche Körperchen wurden nahe dem Mittelstück des Kernes beobachtet, jedoch lasse ich die Natur derselben unbestimmt, da ich keine Theilungen dieser Körper warhgenommen habe.

Interessanter als der Bau des ausgebildeten Thieres, ist die Sporenbildung. Bekanntlich producieren die europäischen Arten von Ephelota freischwimmende Sporen auf der apicalen Fläche des Körpers. Diese wurde auch in unserer Art beobachtet. Während aber die europäischen bewimperten Sporen keine Tentakeln tragen, *besitzen unsere Sprösslinge gut ausgebildete Greif- und Saug-Tentakeln, selbst wenn sie noch nicht von Mutterkörper losgelöst sind.* Es findet sich in unserem Thierchen noch eine zweite Art von Sprösslingen, welche die ganze Gestalt des erwachsenen Individiums annehmen, wenn sie noch mit dem Mutterkörper zusammenhängen.

Die Zahl dieser Sprösslinge wechselt sehr (1–16), je nach der Grösse des Mutterthiers. Es kann als Regel angenommen werden, dass ein grosseres Thier mehr Sporen als ein kleineres besitzt.

Ueber die systematische Stellung des Thieres kann ich nicht bestimmt sagen. Allerdings besitzt die Art eine auffallende Aehnlichkeit mit der europäischen Ephelota gemmipara. Ob man aber, nach den oben angegebenen Merkmalen, unsere Art als eine neue anzusehen darf, lasse ich noch unentschieden. Falls es aber so wäre, so möchte ich das interressante Thierchen zum Ehren des Herrn Professor Dr. BÜTSCHLI, "*Ephelota Bütchliana*" nennen.

C. ISHIKAWA.

Die Entwickelung der Gonophoren bei Physalia maxima, von **Seïtaro Goto.** Journal of the College of Science, Imp. Univ., Tokyo. Vol. X, Pt. II, 1897, p. 176–191. With one Plate.——This investigation

was carried on at the suggestion of Prof. BROOKS in the Biological Laboratory of the Johns Hopkins University, and was undertaken primarily with the object of settling the question as to the nature of the so-called female gonophores of HAECKEL, which are, however, regarded by BROOKS and CONKLIN as swimming organs. The question is left unsettled, as the writer has not observed any germ cells in these structures. Considering their muscular nature it is very possible that these organs have really a locomotory function, as claimed by BROOKS and CONKLIN. If this is the case, then we know nothing yet about the females of *Physalia*.

The so-called female gonophores are provided with a ring-canal and four radial canals. The manubrium is present as a simple protuberance of the ectoderm in the centre of the subumbrellar cavity. The bell-nucleus is formed by the wandering in of interstitial cells from the ectoderm.

Male gonophores were also studied, and the wandering of germ cells observed. These take rise from the endoderm cells of the young bud and wander out one by one into the subumbrellar ectoderm. The germ cells have no distinct membrane, so that they appear imbedded in a common mass of protoplasm. The cells of the subumbrellar ectoderm are comparatively few and are, as in the so-called female gonophores, the cells that have wandered in from the ectoderm, as described in a preliminary note published elsewhere (Johns Hopkins Univ. Circulars, no. 119).

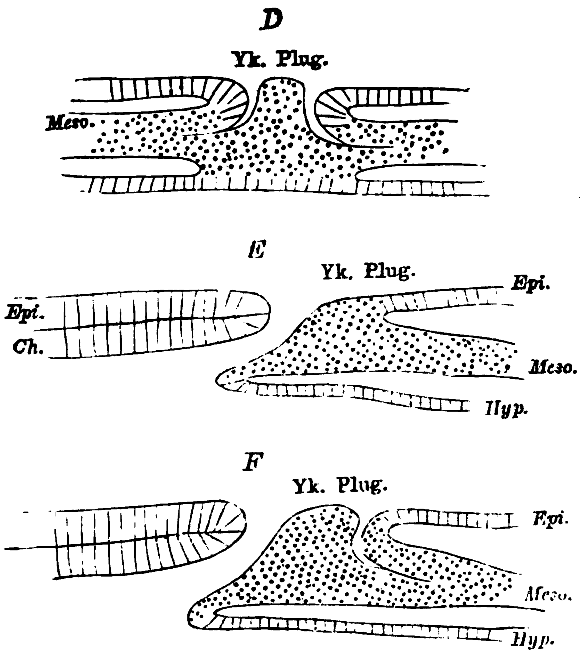
The male gonophores have two radial canals when young; the mature ones are, however, entirely destitute of them.

S. GOTO.

On the Fate of the Blastopore, the Relations of the Primitive Streak, and the Formation of the Posterior End of the Embryo in Chelonia, together with Remarks on the Nature of Meroblastic Ova in Vertebrates, by K. Mitsukuri. Contributions to the Embryology of Reptilia, V. Jour. of the College of Science, Imp. Univ., Tokyo. Vol. X, Pt. I, p. 1–118. Pl. I–XI.—In early stages of Reptilian embryos, there is always an area free from the epiblast, directly behind the blas-

topore. When the latter becomes horse-shoe shaped, this area is enclosed within it and becomes easily noticeable (fig. 2, A). Transverse and longitudinal sections through the spot in question are as in fig. 1. In Contrib. I, ISHIKAWA and the author have identified this epiblast-free mass with the yolk-plug of the Amphibian ovum. The structure has also been noted by other writers, and its theoretical significance has been interpreted in various ways. The author, in the present Contribution, follows the fate of this "yolk-plug" stage by stage in three species of Chelonia, *Trionyx japonicus*, *Clemmys japonica*, and *Chelonia caouana*.

Fig. 1.



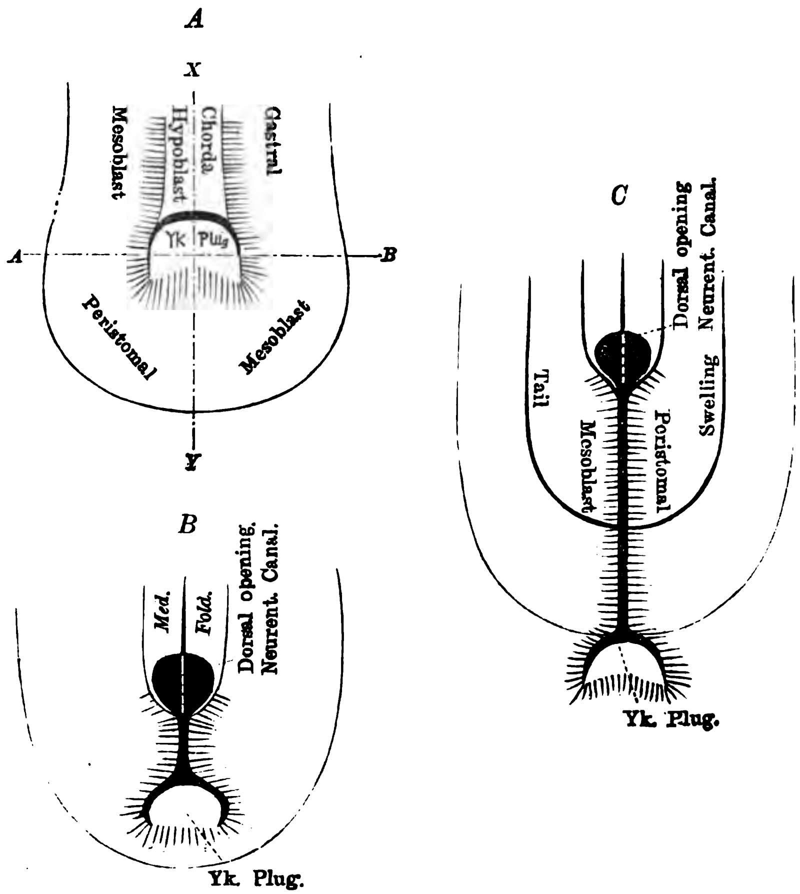
D. Transverse, section through the line AB, E. Longitudinal, section through the line X Y, in fig. 2 A. F. Interpretation of the section E.

When the medullary folds arise and reach the posterior portion of the embryonic shield, they embrace the yolk-plug between their posterior ends as in a vice, and compress it laterally, thus lifting it up to the level of their dorsal surface. The yolk-plug meanwhile keeps its own independence.

The yolk-plug now apparently *recedes* leaving in its track a groove from which the cells are proliferated. This movement backward of the yolk-plug is believed by the author to be caused by the active proliferation of cells from the lateral blastopore lips, while pressing to meet each other in the median line. As cells thus proliferated accumulate, they form a mass which necessarily pushes the yolk-plug backwards. This pushing goes on, until the yolk-plug is placed at about the edge of the

embryonic area. The edges of the groove (or track left in the wake of the yolk-plug) must therefore be considered the lateral blastopore lips. Fig. 2, A, B, C will make this clear. A is the stage in which the yolk-plug has not yet begun its backward movement; in B it has moved some distance, and in C it has reached its final position. In the last stage, the blastopore therefore consists of three parts :—

Fig. 2.



Diagrams showing three successive stages in the development of the posterior part of the embryo.

(1) the dorsal opening of the neurenteric canal.
(2) the groove between (1) and (3).
(3) the groove around the yolk-plug in its final position.

The line of cell-proliferation from the blastopore lips of these parts is the *primitive streak*. In *Chelonia*, and *Clemmys*, a groove is distinct on the streak and represents the *primitive groove*; in *Trionyx*, it is absent, although sections show that cell-proliferation takes place just the same.

The anterior half of the primitive streak is much thicker than the posterior half and gives rise to the mass known as the "Endwulst." The posterior half remains thin to the end. The anterior thick part rises as the *tail-swelling*. This is formed by the addition of the new cell-mass on the dorsal surface, in other words, *by upheaval or elevation and not by folding*.

When the tail has arisen to some height, the primitive streak and groove should of necessity be found over the dorsal median line of the tail, around its tip to the ventral median line, and then be continued to the thinner part of the primitive streak outside the embryo proper, until they reach the yolk-plug. They are thus S-shaped. Such a condition is actually seen in *Chelonia* up to quite a late stage. In *Clemmys*, the anterior part of the streak and groove over the tail disappears rather early. In *Trionyx*, the groove does not exist from the first, and the streak also disappears early from the tail part.

In the tail which lengthens itself backwards, the medullary chord, the notochord, the enteron, and the mesoblast are differentiated *in situ* in the tissue surrounded by the epiblast.

The primitive streak finally disappears entirely by the separation of the layers, with the exception of a short stretch on the ventral surface of the tail. The proctodæum is formed at this point.

The yolk-plug, at the latest stage observed, stands out as an appendage of the epiblast. Probably it persists to a late stage as a rudimentary useless structure. In *Clemmys*, it is elongated posteriorly and forms on the floor of the posterior amniotic tube a prominent ridge, the significance of which is not clear.

In *Theoretical Considerations*, the developmental processes as above described are compared in detail with those brought out by SCHWARZ, SEDGWICK, the ZIEGLERS and others in Elasmobranchii and the identity of the so-called yolk-plug in Chelonia with the large yolk-mass of Elasmobranchii is maintained. The conclusion is reached: "*the course of events described in the preceding pages as taking place in the posterior portion of the embryonic area resulting in the formation of the posterior part of the embryo in Chelonia is a repetition, in a rudimentary*

form, of the process affecting the homologous parts in Elasmobranchii" (p. 88).

Also "It seems most reasonable to conclude that in course of phylogenetic development, the yolk which is homologous with the yolk-mass of the Elasmobranch egg must have dwindled in size and been lost from the eggs of the ancestors of the Amniota. This yolk-mass which I may call the primary yolk-mass has, however, left in some eggs (*e. g.* in the Chelonian egg) its rudiments in the structure known as the primitive plate and its direct derivative, the problematical cell mass* behind the blastopore. In further course of development, the eggs of the ancestors of the Amniota acquired for the second time a large yolk-mass which I may call the secondary yolk-mass. It is this which we see in the Amniota eggs of the present day. * * * Thus it becomes imperative to distinguish the meroblastic egg of the Elasmobranchii from the meroblastic egg of the Amniota. The former may be called the *primary meroblastic ovum* or *proto-meroblastic ovum* and the latter the *secondary meroblastic ovum* or *meta-meroblastic ovum*" (p. 90).

Comparisons are also briefly made with the processes seen in Amphibia, Aves and Mammalia.

Finally, the classification of the vertebrate eggs is made as follows:—

I. PRIMARY TYPE. (a) *Archi-Holoblastic* (Amphioxus), (b) *Proto-Holoblastic* (Cyclostomi), (c) *Proto-meroblastic* (Elasmobranchii, Teleostei) (d) *Meso-holoblostic* (Amphibia ?).

II. SECONDARY TYPE. (a) *Meta-meroblastic* (Reptilia, Aves), (b) *Meta-Holoblastic* (Mammalia).

In a postscript, WILL's article "Die Anlage der Keimblätter bei der Eidechse (Lacerta)" *Zool. Jahrb. Abth. f. Anat. IX. Bd.* is reviewed.

K. MITSUKURI.

A Living Specimen of Pleurotomaria Beyrichii.——By the kindness of Alan Owston, Esq. of Yokohama we were favored, on the 31st of March last (1897), with a view of a living individual of that rare mollusk, *Pleurotomaria Beyrichii.* The specimen had been received by him, the day before, and had probably been caught by a long-line at the Okinosé Bank off Boshū. The animal was not very lively and could not be persuaded to extend itself fully. At the utmost, we were able to see the foot and a part of the head. The sole of the foot was straw-yellow. The side of the foot and the throat were mottled with large and small

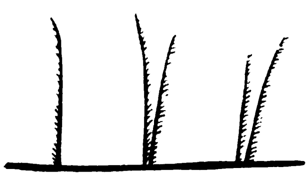
* I. e. the "yolk-plug."

patches and streaks of deep carmine-red on the ground color of reddish-yellow. The proboscis was uniformly deep carmine-red. The left tentacle had a small branch near the tip. On the sides and the posterior aspect of the foot, we were able to make out two lobes, one standing up from each side of the foot and applied to the shell. It seemed probable to me that when fully extended, these lobes enveloped the shell to a greater or less extent—a supposition which is strengthened, as was first pointed out by Mr. NAMIYE, by the fact that the shells of Pleurotomaria, hitherto found, are all extremely clean and have never barnacles, worm-tubes etc. attached to them. The mantle was not at all visible and we were thus not able to see how it is related to the slit on the outer lip. As this is, so far as we know, the first time, a living specimen of Pleurotomaria has come into the hands of a naturalist, it has been thought worth while to put the fact on record.

K. MITSUKURI.

The Ophiurian Shoal.——In the course of a collecting tour which we made last spring (1896) in the provinces of Satsuma and Osumi (in Kiushiu), we met with a curious mode of occurrence of an ophiurian which is perhaps worth noting here. On the eastern side of the island Sakurajima in the Bay of Kagoshima, there is a small village called Kurokami. A few hundred metres off the sea-front of this place there is a small sandy shoal named Hamashima which becomes exposed at low tide. Towards the evening of April 1, after having skirted the island the whole day, we found ourselves approaching this shallow. As our dug-out boat struck the bottom, all of us eagerly waded into water which was at the time fifteen to twenty centimeters deep. We were soon struck with very curious objects. Numerous slender stalks a few millimeters in diameter and 10–15 centimeters high were standing up from the bottom, looking, for all we knew, like the stems of so many weeds. Along one side of each stalk, there was, however, a row of white papilla-like structures. These stalks were mostly by twos, although sometimes only one was standing by itself. We do not remember having seen three making a group. As we dug to learn more about these curious objects, we were greatly surprised to find that they were the arms of ophiurians, and that the papilla-like structures were therefore no doubt tube-feet. So far as we could see, there was no difference between the five arms of the

Fig. 3.



animal and why only one or two of them should be thus thrust upwards into the water, and kept upright there, was a mystery. It seemed probable to us that it was done to secure respiration. The sand of the shoal was literally packed with these animals, and there must have been hundreds of thousands or perhaps millions in the whole shallow. We did not hesitate to give the spot the zoological sobriquet of the "Ophiurian Shoal." These ophiurians were of a species belonging to the *Amphiuridæ* and near or in the genus *Ophiopsila*. Together with them we found a species of *Synapta* in tolerable abundance and one individual of *Sipunculus*.

K. MITSUKURI and T. HARA.

Zoological Society of Tokyo.——The monthly meeting of the Society for January was held **at 2 P.M. on Saturday, Jan. 23,** in the lecture room of the Zoological Institute of the Science College. Prof. MITSUKURI in the chair. The following papers were read:

Mr. S. YOSHIWARA on "Two Japanese Species of *Asthenosoma*." The substance of this paper is found elsewhere in the present part of this periodical.

Mr. H. WATANABE on "the Phosphorescence of *Cypridina Hilgendorfii*, Müller." The conclusions arrived at by the author were as follows:

(1) The phosphorescent ostracod known in Misaki as "marine fire-fly" is *Cypridina Hilgendorfii*, Müller.

(2) The phosphorescent organ of this ostracod is a group of elongated, unicellular, epidermal glands opening to the exterior symmetrically on either side of the median line, on the external edge of the upper lip —the glands called by Claus "Oberlippendrüse" in 1873.

(3) The glands secrete, together with the transparent, colorless "secretive vacuoles," yellow homogeneous granules which are stored in the necks of the glands.

(4) Physical as well as chemical stimuli cause contraction of the muscles of the upper lip, and the secretion of the glands is thereby mechanically squeezed out.

(5) The phosphorescence of *Cypridina Hilgendorfii* is a chemical phenomenon accompanying the contact of pigment of the granules with the external medium, i.e. sea water.

(6) The presence of free oxygen in any considerable quantity is

not essential to the manifestation of phosphorescence; on the contrary the presence of water, unless it be strongly acid, is a *sine qua non* of the phenomenon.

(7) As the phosphorescent organs of the metazoa seem to be generally derived from a glandular transformation of the ectoderm, so physiologically they are attributable to a pigment producing change in the glands; the phosphorescence being simply a collateral phenomenon due to contact of a yellowish pigment, capable of changing into red or green, with water. It is, generally speaking, a means of frightening other animals, possessed by certain aquatic organisms or those living in a moist medium.

Prof. MITSUKURI exhibited some specimens of *Peripatus* sent him from the University Museum of Cambridge, England.

The meeting adjourned at 4.30 P.M.

The monthly meeting of the Society for February was held at the usual place at 2 P.M. on Saturday, Feb. 20. The President in the chair. The following papers were read:

Prof. MITSUKURI on "the Changes accompanying Growth in the Calcareous Bodies of *Stichopus japonicus*, Selenka." The substance of this paper is found elsewhere in this periodical.

Dr. KISHINOUYE on the "Petasma and Thelycum of some Shrimps." The author dwelt at length on the morphology and physiology of these structures in several species. The substance of the paper is promised in a near future in the pages of this periodical.

The meeting adjourned at 4 P.M.

The monthly meeting of the Society for March was held at the usual place at 2 P.M. on Saturday, March 2. The President in the chair. The first part of the meeting was taken up by business concerning the issue of a new periodical in European languages. The following papers were then read:

Mr. H. KUROIWA on "the Zoology of the Ryukyu Islands." The author gave an interesting, detailed account of his experiences as a collector in these islands, referring specially to the habits of the gigantic bat and the dugong.

Mr. H. WATANABE on "Plankton and Tidal Currents." The author dwelt on a close correlation of the quantity of plankton and tidal currents, as shown in his table of quantitative plankton studies made in Misaki. He also exhibited some specimens of the plankton.

Mr. IKEDA exhibited a specimen of an octopod of the genus *Amphitretus*, recently obtained of a Misaki fisherman.

The meeting adjourned at 5 P.M.

List of Japanese Zoologists.——As some changes have taken place among our zoologists since the publication of FRIEDLÄNDER's Adressbuch, we believe the following list with adresses will be welcome to our foreign *confrères*.

Zoological Institute, Science College, Imp. Univ., Tokyo.

Mitsukuri, Kakichi, Ph. D., *Rigakuhakushi*. Director, and Professor of Zoology in the College. Specialty—*Embr. Vert., Syst. Holoth.*

Ijima, Isao, Dr. Phil., *Rigakushi, Rigakuhakushi*. Professor of Zoology in the College. Spec.—*Plathel., Aves, Spong.*

Namiye, Motoyoshi. Assistant. Spec.—*Syst. Vert.*

Tsuchida, Toshizō. Taxidermist.

Nagahara, Kōtaro. Draughtsman.

Takakura, Usamaro, *Rigakushi*. Grad. Stud. Spec.—*Nemert.*

Hara, Jūta, *Rigakushi*. Grad. Stud. Spec.—*Myzostomum, Crin.*

Ōmori, Senzō, *Rigakushi*. Grad. Stud. Spec.—*Actin.*

Aida, Tatsuo. Grad. Stud. Spec.—*Chaetogn.*

Yoshiwara, Shigeyasu. Grad. Stud. Spec.—*Echin.*

Watanabe, Hisakichi. Grad. Stud. Spec.—*Planktol., Trachomed.*

Iizuka, Akira. Grad. Stud. Spec.—*Polych.*

Nishikawa, Tōkichi. Grad. Stud. Spec.—*Embr. Pisces.*

Kōoyama, Torata. Grad. Stud. Spec.—*Oligoch.*

Terazaki, Tomekichi. Special Student. Spec.—*Embr. Aves.*

Miyajima, Mikinosuke. Spec.—*Myriap.*

Ikeda, Sakujiro. Spec.—*Cephalop., Amphib.*

Shishido, Ichiro, *Rigakushi*. Spec.—*Syst. Pisces.*

Zoological Institute, Agricultural College, Imp. Univ., Tokyo.

Ishikawa, Chiyomatsu, Dr. Phil., *Rigakushi, Rigakuhakushi*. Director, and Professor of Zoology in the College. Spec.—*Cyt., Arthrop.*

Sasaki, Chūjiro, *Rigakushi, Rigakuhakushi*. Professor of Zoology in the College. Spec.—*Insecta.*

Tsuchida, Toshiwo. Taxidermist.

Anatomical Institute, Medical College, Imp. Univ., Tokyo.

Koganei, Ryosei, Dr. Med., *Igakuhakushi*. Professor of Anatomy in the College.

Osawa, Gakutaro, *Igakushi*. Now in Freiburg i. Br., Germany.

Higher Normal School, Tokyo.

Iwakawa Tomotaro, *Rigakushi*. Professor of Zoology.

Frist High School, Tokyo.

Goto, Seitaro, *Rigakushi, Rigakuhakushi*. Professor of Biology. Spec.—*Plathel., Embr. Echin.*

Nobles' School, Tokyo.

Hatta, Saburo. Professor of Biology. Spec.—*Embr. Cyclost.*

Fisheries Commisson, Tokyo.

Kishinouye, Kamakichi, *Rigakushi, Rigakuhakushi.* Spec.—*Embr. Arthrop., Medus.*
Kitahara, Tasaku. Spec.—*Ichth.*
Ōtaki, Keinosuke. Spec.—*Ichth.*

School of Fisheries, Tokyo.

Matsubara, Shinnosuke. Spec.—*Syst. Pisces.*
Fujita, Tsunenobu, *Rigakushi.* Spec.—*Moll.*

Rakusuien, Mayebashi.

Inaba, Masamaru, *Rigakushi,* Spec.—*Hydromed.*

Yamaguchi High School, Yamaguchi.

Oka, Asajiro, Dr. Phil., *Rigakuhakushi.* Professor of Biology. Spec.—*Tun., Polyz., Hirud.*
Yasue, Toyotaro. Instructor of Zoology.

Fifth High School, Kumamoto.

Nakagawa, Hisatomo. Professor of Biology.

Agricultural School, Fukushima.

Toyama, Kametaro, *Nōgakushi.* Principal of the School. Spec.—*Spermatog.*

Fisheries Department, Sapporo, Hokkaido.

Nozawa, Shunjiro, *Nōgakushi.* Spec.—*Insec., Syst. Pisces.*

Agricultural College, Sapporo, Hokkaido.

Matsumura, Matsutoshi, *Nōgakushi.* Spec.—*Entom.*
Minami, Takajiro, *Nōgakushi.* Spec.—*Entom.*

Yushukwan, Fukuoka.

Matsui, Katsunori, *Rigakushi.*

Gifu.

Nawa, Yasushi. Spec.—*Entom.*

Eihikosan, Fukuoka.

Takachiho, Norimaro. Spec.—*Entom.*

Normal School, Naha, Ryukyu.

Kuroiwa, Hisashi. Professor of Biology.

PRINTED AT THE "TOKYO PRINTING CO., LD." TOKYO, JAPAN.

On a Mode of the Passage of the Eye in a Flat-Fish.

By T. Nishikawa.

Zoological Institute, Imp. Univ., Tokyo.

On a very quiet and brilliant morning of Aug. 10th. of last year, a transparent young flat-fish was caught with a surface-net at the mouth of the harbor of Misaki. The fish was then swimming vertically; but when placed in a glass vessel, it turned on its right side and remained motionless on the bottom for hours. It was 1.3 cm. in length and about 0.4 cm. in height. It had no pigment, and was quite transparent. The mouth was asymmetrical, a single nostril was present on the left side, and the vertical fins were confluent, while the pectorals were not to be seen. The two eyes were then situated symmetrically with reference to the longitudinal axis of the body. Fig. 1 represents the profile of the anterior part of this flat-fish, as drawn on the morning of that day. It will be seen that the dorsal fin has already extended itself along the head to the anterior extremity of the snout, but this extended part of the dorsal had as yet no fin rays, only the soft tissues having grown forwards. What is remarkable is that this anterior extension, although applied closely to the head, *has not coalesced with it,* and that at the inner base of the anterior extension, there *was a clear large hole passing from one side to the other.* The posterior border of the hole was about on a level with that of the eyes.

Fig. 1.

As the animal was watched, the right eye gradually travelled, with

the rotation of the head, towards the dorsal side of it, and approached more and more the base of the dorsal fin ; eventually it passed into the hole between the head and the anterior extension of the dorsal.

Fig. 2.

This stage is shown in fig. 2, which was drawn at 10 : 30 P.M. of the same day ; the anterior extension of the dorsal fin has not yet united with the head. The right eye then emerged on the left side and moved towards its final position. After this rotation, there occurred a fusion of the head and the anterior part of the dorsal fin, from the base towards the snout. Thus it was evident that the hole in front of the base of the dorsal was intended for the passage of the right eye, which travelled around the dorsal surface of the head, from the right to the left side. There occurred neither a new formation of the orbit for the right eye on the left side nor the atrophy of the original orbit of the right eye on the right side, as in the case of the *Plagusia* described by AGASSIZ.*

The fish died on the evening of the next day, after the rotation of the right eye was finished; it had then many pigment-spots on the left side, and the snout was produced backwards into a hook, covering the mandible. The general characters of the young fish being still very incomplete, it was not possible to identify it, but it is probable that it belongs near the genus *Plagusia*.

According to the observations of AGASSIZ, there are two different modes of the passage of the eye in flat-fishes; one of them is undergone by a majority of species, such as *Pleuronectes*, *Pseudorhombus*, and others. In this mode, the eye on the side which in the adult is blind, travels round the dorsal side of the head, till it attains its final position,

* A. AGASSIZ.—On the Young Stages of some Osseous Fishes. II. Development of the Flounders. Proc. of the Amer. Acad. Arts & Sci., vol. XIV. 1878.

and only after this rotation, the dorsal fin grows forwards beyond the level of the eyes. In the second mode which is undergone by *Plagusia*, the dorsal fin grows forwards to the snout, while the eyes are still in their initial positions. When the right eye in the course of rotation approaches the base of the dorsal fin, it gradually sinks into the tissues of the base of the dorsal fin, between it and the frontal; so that the right eye is now not to be seen on the surface of either side. A very interesting circumstance was observed by AGASSIZ, that a fresh orbital opening is formed for the right eye on the left side, and that the original orbit of the right atrophies after the rotation of the eye; therefore in a certain stage of metamorphosis, there are three orbital openings: one on the left side, the original orbit of the left eye; a small one on the left side, the new orbit for the right eye; and a small orbit on the right side, the remnant of the original orbit of the right eye. He says, "With the continued sinking of the right eye, the gradual resorption of the tissues, and the closing up of the old orbit, as the eye works its way across the head, we eventually get the right eye entirely over to the left side. It has now, by a movement of translation and of rotation, penetrated through the tissues between the base of the dorsal fin and the frontal bone; having apparently passed through the head, as was suggested to STEENSTRUP, by his examination of the alcoholic specimens which furnished him the materials for his paper on *Plagusia*."

In the present flat-fish, the dorsal fin also grows forward before the rotation of the right eye, but this anterior extension does not unite with the head, and there is a distinct hole bounded by the head and the anterior extension of the dorsal fin, for the passsge of the right eye, which travels round the dorsal side of the head without sinking into its tissues. The orbit of the right eye travels also with the rotation of the head from one side to the other, as in the case of a number of flat-fishes. Now if we compare this mode of the passage of the eye with the first mode described by AGASSIZ, which is undergone by a majority of flat-fishes, we find little difference between them, beyond the fact that before the rotation of the eye takes place, the dorsal fin grows in

our specimens forward to the snout and lies in apposition with the head. If, on the other hand, the anterior extension of the dorsal fin should coalesce with the head and the hole should be obliterated before the rotation of the right eye, there would be nothing for the latter to do, except to have a hole for its passage pierced through anew, in the spot where the hole is present in our specimen. And this is what takes place in AGASSIZ's second mode as observed in *Arnoglossus* by EHRENBAUM,* and in *Plagusia* by AGASSIZ, although in the last genus the change of the orbit of the right eye seems to indicate still further modifications. It is thus evident, that the mode of the passage of the eye in the flat-fish which has come under our observation, forms a *connecting link between that of the ordinary flat-fishes* (the first mode of AGASSIZ), *and that which takes place in Arnoglossus and Plagusia* (the second mode of AGASSIZ). *In every case, the passage of the eye from one side to the other in flat-fishes is morphologically along the dorsal surface of the head.*

* I regret that I have not had access to EHRENBAUM's original paper. The above has been gathered from the extracts in Jour. Marine Biol. Ass. Plymouth, vol IV, no. 4, p. 380.

Printed July 20, 1897.

On the Growth of the Ovarian Ovum in Chaetognaths.

(Preliminary Note.)

By **T. Aida.**

Zoological Institute, Science College, Imp. Univ., Tokyo.

With Pl. IV.

No special investigation on the mode of growth of young ova in the ovary of chaetognaths has, as far as I know, hitherto been undertaken. It may not therefore be superflous to describe here briefly the results of my observations on this point, as there are some peculiar features.

The primary germ-cells are produced within the germinal epithelium in several groups irregularly scattered. In fig. 4 which is a median longitudinal section of the anterior part of the ovary, we find five groups of these cells which are easily distinguished from the ordinary columnar cells of the germinal epithelium (*g.e.*) by their spherical form and large nucleus (omitted in the figure). These cells, I think, are produced by repeated mitotic division from the cells of the germinal epithelium, as I have often observed karyokinetic figures within these groups.

They do not remain long within the germinal epithelium, but after a certain stage are pushed outside it, owing no doubt to the growth of the underlying epithelial cells and the increase in their own bulk. They do not nevertheless lose their relation to the germinal epithelium: each of them is connected with it by a stalk composed of one or more short cells, as GRASSI* has described. As these ova have no follicle, it is evident that the stalk has some relation to their growth. *My observations*

* I Chetognathi. Fauna und Flora d. Golfes v. Neapel, No. 5, 1883.

show that the cells which constitute the stalk—or stalk-cells as I shall call them hereafter—are produced from the cells of the germinal epithelium by a succession of amitotic divisions and fuse one after another with the ovum until the latter becomes mature.

We thus find two or three stalk-cells at the base of a young ovum. Fig. 1 is a cross section of the ovary of *Sagitta bipunctata* hardened with Flemming's stronger solution. Each of the ova *a* and *b* has two stalk-cells at its base, where the germinal epithelium makes a deep indentation. *a* is a nearly mature ovum and its cytoplasm shows a fine cobweb structure. It has at its base a large stalk-cell which appears as a stopper to the spaceous indentation of the germinal epithelium under the ovum, and an indication of another cell which has been absorbed by the ovum. *b* is a younger ovum and its cytoplasm is a dense reticular mass. There is a distinct stalk-cell which has been taken up by the ovum, and below it there is another which serves as the stopper to the indentation in the germinal epithelium. This last cell is smaller than the stopper cell of the ovum *a*, as is also the indentation of the germinal epithelium under it compared with the corresponding structure under the ovum *a*.

In order to show that these stalk-cells are produced from the germinal epithelium by amitotic division a few of the nuclei undergoing that process have been sketched, and are reproduced in fig. 2. We find in the germinal epithelium two kinds of nuclei; those belonging to the first kind have each a looped varicose chromatic filament (fig. 2, *b* lower nucleus) and lie generally in the deeper portion of the epithelium; the nuclei belonging to the second kind, which are found in the external portion of the germinal epithelium (fig. 2, *a*, *b*, upper nuclei, *c*, *d*.), have many dispersed chromatic particles and a central body of aggregated chromatic substance containing in its center a nucleolus-like structure, which can be well differentiated from the peripheral chromatic portion by a double-staining with orange G and hæmatoxylin. The second kind of nuclei is produced by direct division from the first class: a part of the long looped chromatic filament is first constricted off as a round

mass constituting the central body of the second kind, and the part which follows it disintegrates into granules and are dispersed within the nucleoplasm. In fig. 2 *b*, the central body has already separated off from the looped chromatic filament, and the outer part of it, which is within the daughter nucleus, is disintegrating into granules.

By a succession of such direct division, several nuclei with a central body are produced within a cell of the germinal epithelium from a nucleus with the looped chromatic filament (*a* and *e* fig. 2, fig. 3). Each of these nuclei then separates with a little protoplasm, as a stalk-cell one after another, and is at last merged into the ovum, the merging beginning from that which is nearest to the ovum. In the ovum *b*, fig. 1, and *a*, fig. 5, the upper stalk-cell is fusing with the ovum and in *c*, fig. 1 and fig. 3, we see half disintegrating nuclei as remains of the fused stalk-cells. But the nucleus with the looped chromatic filament goes on dividing and producing daughter nuclei indefinitely. After a certain number of division, it is converted wholly into a nucleus with the central body. Two lower nuclei of *a*, fig. 2, are in their last division. The chromatic filament being stretched equally into two nuclei after the completion of division, two similar nuclei with the central body will be produced. The central body is, in this case, produced from the central part of the equally divided chromatic mass, the outer part of it being disintegrated into the granules.

The nucleus with the central body may also divide amitotically. The separation of the central body is followed by the constriction of the nucleus in a manner similar to the amitotic division of nucleolated nuclei as described by various authors (*d*, *e*, fig. 2).

Besides these amitotic division which results in the formation of equal sized daughter nuclei, the nucleus of both kinds may divide unequally in size and produce one or more small fragments (*b*, *c*, fig. 2). It is not rare to find a number of these fragments at the base of a nucleus with the looped chromatic filament.

Thus the nuclei of the cells in the germinal epithelium multiply by direct division and separate as stalk-cells. These are one after another

absorbed into the ovum to which they are attached, until the latter has fully grown. Often we see these cells arranged under an ovum like a stair, fig. 5, as GRASSI found in the young ovum of some species (*Sagitta Claparedi*). I was unable to find a stalk cell with such a long tail-like portion as GRASSI describes; all the stalk cells of our specimens of *Sagitta bipunctata*, *Sagitta enflata*, *Sagitta serratodentata*, etc. are round or rectangular.

The ova, which have no follicle, must take their nutriment from, or through, these stalk-cells. I am inclined to believe that the stalk-cells do not merely serve as food materials to the ova, but that they in some manner perform the function of actively nourishing the ova, as a follicle or a nutritive cell does, and that when they lose their capacity for that function are merged into the ovum at whose base they lie, and are replaced by the next cell. When all the stalk cells derived from a single epithelial cell are taken up, others will be produced from a neighboring cell to nourish the same ovum to its maturation. Thus as the cells of the germinal epithelium are constantly taken up by an ovum, there is necessarily formed an interruption in the epithelium directly under the ovum, and this interruption becomes the wider, the greater the number of cells taken up.

The last one of the stalk-cells, which is attached to the ripe ovum, is always larger than its predecessors and behaves somewhat differently from them. It is never fused with the ovum to which it is attached, but remains as a stopper of the interruption in the germinal epithelium (*a*, fig. 1). It is this stalk-cell which CONANT* has described as preceding the ovum in its passage to the temporarily formed oviduct. I must notice here that the deepness of the interruption varies according to the thickness of the germinal epithelium. In animals which have a thin germinal epithelium, *e. g.* small specimens of *Sagitta bipunctata*, *Sagitta enflata*, *Sagitta minima*, etc., it is so shallow that the enlarged stalk-cell nearly fills it up, and is easily overlooked.

From certain stages in its development, an ovum shows at its

* Ann. & Mag. Nat. Hist. ser. 6, vol. 18, no. 105, 1896.

periphery many globules of various size, which may be called yolk-nuclei (the black dots in the ova of fig. 1). They show similar reactions to coloring matters as the inner part of the central body or the nucleolus of the stalk-cell nucleus. Probably they are derived from the latter, which persists after the fusion of the stalk-cells and changes its peripheral chromatic substance to a refractive amorphous mass similar to its inner part, and is metamorphosed into small globules which by reunion produce larger ones.

As to the question whether the ovum passes outside through the ovisperm duct or through a temporarily formed passage as CONANT insists, I am unable to give an opinion, as none of my specimens had ova in this stage.

In conclusion I may remark once more that in the germinal epithelium of chaetognaths, there are two kinds of nuclear division, mitotic and amitotic; and that the ova are produced by mitotic, and the stalk or nutritive cells by amitotic, division. This fact seems to lend support to the hypothesis of ZIEGLER and VOM RATH on the fate of the cells produced in these two different ways.

Printed July 20, 1897.

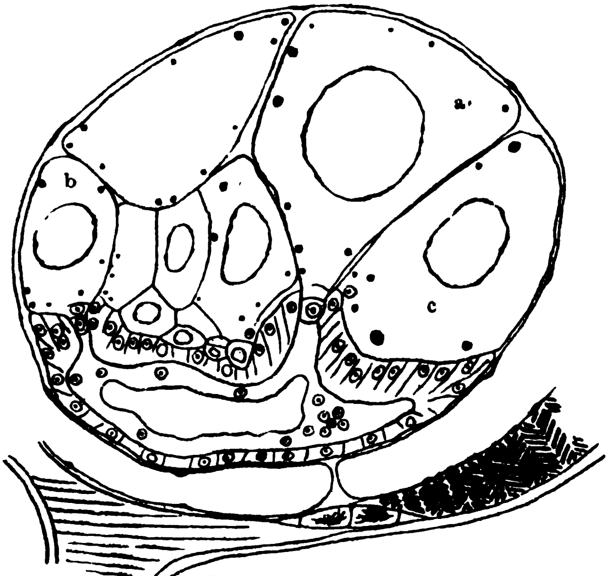


Fig. 1.

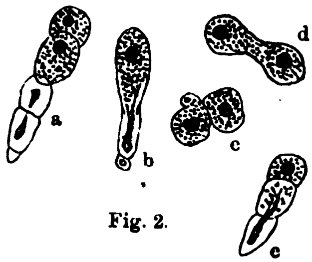


Fig. 2.

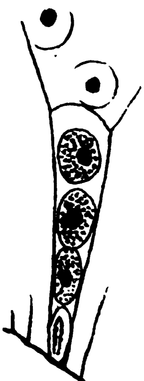


Fig. 3.

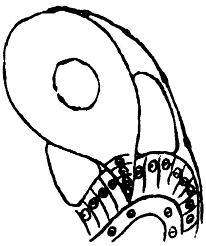


Fig. 5.

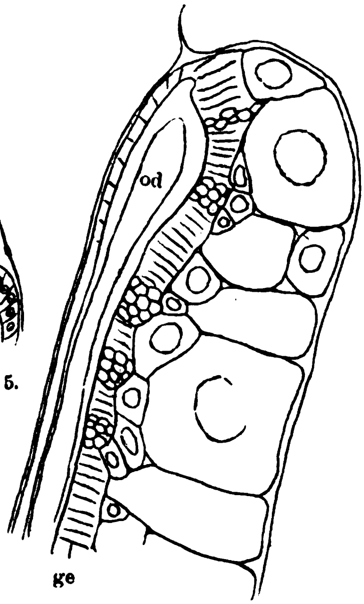


Fig. 4.

Notes on the Paludina-Species of Japan.

By **T. Iwakawa.**

Professor of Zoology, Higher Normal School, Tokyo.

With Pl. V.

While engaged in reärranging the shell collection of the Imperial Museum at Uyeno, Tokyo, I have found among it a pretty extensive series of native *Paludina* specimens from localities ranging from Awomori at the north-eastern extremity of Hondō as far south-west as the island of Shikoku. Advantage was taken of this opportunity to make a systematic study of the genus, but as I soon felt the desirability of having more materials in order to arrive at satisfactory results, and especially as the labelling of localities appeared in some cases unreliable, I have given special attention to obtaining fresh paludinas while on a collecting tour in the northern provinces during the summer of 1896. On that occasion, I enjoyed the agreeable company and valuable assistance of Prof. C. Ishikawa and also the coöperation of Messrs. K. Matsuura and I. Horikawa, assistants to the Zoological Department of the Imperial Museum. Two hundred and eighteen fresh specimens were brought home from different localities, chiefly in the provinces of Mutsu, Rikuchu, Rikuzen, and Iwashiro. These, added to the old specimens of the Museum, formed a material of over five-hundred, which number further received considerable augmentation through the kind gifts of several friends in different parts of the country. For specimens from middle Japan I am especially indebted to Mr. M. Kawatsura of Kamisuwa, Prov. Shinano, and to Mr. Y. Nawa of Gifu. Mr. Kuroiwa of the Normal School of Naha has kindly sent me specimens from Yayeyama Shima, Loo-choo Islands. To all the gentlemen above named I wish here to tender my thanks.

Fauna Japonica extra-

[illegible] ama, Hakone

[illegible] Yokohama,

[illegible] mentioned.

[illegible] and

[illegible] It seems

[illegible] first described.

[illegible] specimens which

[illegible] them, but I

[illegible] More speci-

[illegible] need of thorough

[illegible] non-validity

[illegible] great variability of

[illegible] of them

[illegible] given by

[illegible] can not all be

[illegible] my material

[illegible] oxytropis.

[illegible] difficulty in

[illegible] Pal. Sclateri

[illegible] as to their specific

[illegible] mixed together in

[illegible] specimens revealed

[illegible] over to oxytropis,

and must therefore be looked upon as varieties of the latter.

In identification I have found it of great importance to bring into consideration the form of young shells in different stages of growth, either found free or taken from within the body of mother shells. For, the young have characteristic shape for each species and are very persistent in their characters in comparison with adults.

1. *Paludina stelmaphora* (Bourgnignat).

Pl. V, figs. 1—4.

The specimens which I refer to this species, have characters essentially agreeing with the original diagnosis of Bourgnignat and with the description given by Kobelt (*loc. cit.*, p. 122). The principal characters are as follows :

Shell swollen, egg-shaped, thin, smooth, with a greenish epidermis, umbilicated. Spire low, with an obtuse apex usually worn out in old specimens. Whorls quite rounded, separated by deep sutures ; each whorl wound round with three punctured lines, which, though sometimes extremely fine, are always present and easily visible to the naked eye. In young individuals the lines are often beset with fine hairs. These punctured or haired lines seem to be peculiar to this species ; they are not found in any other Japanese species of *Paludina*, in which we find raised lines instead. They were described by Kobelt but were omitted in his figures. Aperture nearly round, obtusely angled at the upper end. Edge of outer lip turned out, consisting of a thin epidermis which is connected with the inner lip by a thin callosity, margined with a black band. In fully grown specimens, the surface of the body-whorl is provided, especially close to the outer lip, with some elevated ribs besides the several lines of growth. Interior of the aperture bluish-colored. Height 43—58 mm. Diameter 26—36 mm. Aperture 22—30 mm. long, 19—23 mm. wide.

Specimens of this species very often present hammered-like sculpture on the surface (*P. malliata*, Reeve). As was correctly recognized by Kobelt, these should not however be made into a distinct

species, since they are connected by intermediate forms with those that are devoid of the sculpture. A collection of *stelmaphora* from one and the same locality may show an abundance of transitional forms from smooth-surfaced individuals to others that have a distinct hammered-like surface. Moreover this character of the shell is not peculiar to *stelmaphora*, being also met with in some individuals of *oxytropis*.

The embryo-shell (fig. 1) of this species is amber-colored and extremely delicate, consisting of only three or four whorls with a very low spire. Each whorl is perfectly rounded at the shoulder except on the body-whorl which is somewhat angular along the middle and is besides provided with exceedingly fine spiral lines. The aperture is generally rounded above, while its basal portion at the lower end of the columella is stretched out so as to form a short canal. As the shell grows, the angle on the body-whorl generally disappears and the three punctured lines characteristic of this species are developed (fig. 2—4).

I have specimens of *P. stelmaphora* from Awomori in Prov. Mutsu, Kogawara Swamp in Prov. Rikuchu, Miyagi in Prov. Rikuzen, Fukushima in Prov. Iwashiro, Kasumigaura in Prov. Hitachi, Tokyo, Aichi in Prov. Owari, Tokushima in Prov. Awa, and Yayeyama Shima. Thus it will be seen that the present species has a very wide distribution in Japan, from Tsugaru Strait as far south as the Loo-choo Islands. At the latter locality, this seems to be the only species of *Paludina* present. according to a private communication of Mr. KUROIWA.

Further it may be noted that this species is confined to shallow water broadly exposed to light, such as rice-fields. So far as my observation goes, it never occurs in such places as lakes or rivers where water is deep and cold.

2. *Paludina ingallsiana*, Reeve.

Pl. V, figs. 5—7.

This is an exceedingly variable species, the several forms of which are well represented and described in KOBELT's monograph. Notwith-

standing its variability, the species is easily distinguishable by the following characters:

Shell pyramidal or turret-shaped, with apex sometimes extensively worn out in mature specimens. Sutures deeply canal-like, owing to the abruptly outstanding edges of whorls, between which edges the whorl-surface is flat or even slightly concave. In some specimens, each whorl is provided with two or three distinct, spiral raised lines; in others there is only one such line on the body-whorl, bringing about an angle at the outer lip. The surface is either rough and incrusted with a reddish substance or perfectly smooth and vividly green. Height 43—51 mm. Diameter 23—30 mm. Aperture 18—25 mm. long, 14—19 mm. wide.

Fig. 5 represents one of the youngest specimens of *ingallsiana* from Lake Suwa. It will be seen that its shape is quite different from that of the corresponding stage of either *stelmaphora* (fig. 3) or *oxytropis* (fig. 9).

This excellent species has hitherto been known only from Lake Biwa, to which I will now add two more localities, Lake Suwa in Prov. Shinano, and Nagoya in Prov. Owari, on the strength of the specimens contained in the Imperial Museum.

In Lake Biwa, it seems to be very common. Mr. K. MATSUURA incidentally obtained there several specimens, while collecting fresh-water fishes together with Prof. C. ISHIKAWA during the summer of 1895.

From Lake Suwa there was originally only one specimen of this species in the Museum. Recently Mr. M. KAWATSURA of that locality has made a collection at my request and kindly sent me a number of fresh specimens.

With respect to specimens from the Province of Owari, of which there are three in the Museum, the exact locality is unknown.

In the north-eastern provinces of Hondō, I could not obtain a single specimen of this species, in spite of my efforts to collect during the excursion of last summer. It is very desirable to ascertain its range

of distribution in Middle Japan and also in the south-western provinces, where it probably also occurs.

3. *Paludina oxytropis*, Benson.

After disposing of the two species above noticed, the rest of my specimens offered some difficulties in being identified. While some of these were referable to *oxytropis* (after KOBELT), others to FRAUENFELD's species *Sclateri* and still others to v. MARTENS' *japonica*, there were many with intermediate characters. After all I have come to the conclusion that *japonica* and *Sclateri* must be regarded merely as varieties of *oxytropis*.

Typical *Pal. oxytropis* (fig. 12) has the shape of a double cone. Spire usually acutely pointed, consisting of 6 or 7 whorls; shell thin and translucent, upper whorls only slightly swollen or nearly flat, separated by narrow and shallow sutures; each whorl provided with three or four distinct raised lines, of which the lowest runs at the sutural line, while the remaining lines run so as to divide the whorl-surface into a corresponding number of zones, usually nearly equal, but sometimes unequal in width. The middle portion of the body-whorl forms a distinct angular ridge, below which there are numerous spiral lines converging towards the umbilicus. Aperture oval but more or less acutely angular above and below; peristome thin and sharp, its portion at the lower end of columella alone being a little turned out; all the extremities of raised lines form more or less acute angles at the margin of outer lip.

Pal. oxytropis var. *japonica* (fig. 17) (=*Pal. japonica*, v. Mart.) differs from typical *oxytropis* in the following characters: shell ovoid-conical, moderately thick and opaque, usually with somewhat obtusely pointed spire; whorls swollen, separated by wide and deep sutures; raised lines indistinct or absent except one on the body-whorl, where it makes a very slight angular ridge. Aperture nearly round, with an obtuse angle only at the upper end, and with thick peristome, which is considerably expanded outwards and downwards.

Pal. oxytropis var. *Sclateri* (fig. 14) (=*Pal. Sclateri* v. Fr.) is distinguished from the typical form by having oval, thicker and heavier shell, with an obtuse apex; whorls swollen, but not so much as in the above variety, and separated by very shallow sutures. Raised lines persist in each whorl, though not so prominent as to give rise to angles at the peristomal margin. Aperture oval, with obtuse angles above and below; edge of peristome very thick, and the outer lip slightly expanded outwards.

Notwithstanding the differences of adults, the young of the typical form and of its varieties all agree in characters. The embryo-shell (fig. 8) is light green and consists of five whorls, with a conical pointed spire. Three raised lines are distinctly to be seen. The last of these lines brings about a conspicuous angle at the margin of the outer lip, the aperture showing four angles in all. The general shape of the shell is that of a double cone.

The main features of embryonal characters above referred to are retained during the growth of the shell (figs. 8—11), to be directly continued further on into the adult stage in the case of typical *oxytropis*, but to deviate at a certain period of growth into the respective definitive characters of *japonica* and *Sclateri*, where these are concerned. This is the ground on which I base my conclusion that *oxytropis* represents the primitive stock, whence *japonica* and *Sclateri* have differentiated.

I will here let follow an account of the specimens collected by myself at different localities in the north-eastern provinces to illustrate how this species varies.

1) Most of the specimens from a muddy stream in Yamagata village near Lake Inawashiro, Prov. Iwashiro, distinctly show the characters of typical *oxytropis*. Fig. 12 was drawn from one of the specimens collected at that place. In four out of fourteen specimens obtained, the spiral raised lines were either indistinct or nearly absent while the whorls were more or less swollen, which characters made them approach either *japonica* or *Sclateri*. In the majority of specimens the three

raised lines were prominent; in some there were one or sometimes two more lines interposed between the first and the second, and in still others another raised line was added above the first. The angular edge of the body-whorl was very prominent in all Yamagata specimens.

The largest individual of the lot measured 70 mm. in height and 55 mm. in diameter, with an aperture 39 mm. long and 29 mm. broad.

2) In the specimens from Shinai Swamp in Prov. Rikuzen, eighteen in all, both typical *oxytropis* and var. *japonica* are represented. Eight are referable to the former and the rest to the latter. In all and even in old specimens the apex is uninjured and the shell perfectly smooth, and vividly green in color. The typical *oxytropis* specimens, although of normal configuration in young stages, have somewhat lower raised lines than those of Yamagata. This seems to indicate that Shinai specimens have a greater tendency to change into *japonica* form.

3) The specimens from a small swamp near the village of Nagahama on the northern shore of Lake Inawashiro are all var. *Sclateri* in both the shape and thickness of the shell, but they still retain the character of typical *oxytropis* in so far as the prominent raised lines are present. The embryo-shells have typical *oxytropis* shape.

4) In specimens from a canal near the village Shariki, Prov. Mutsu, the definitive characters of var. *Sclateri* are settled, although the embryo-shells are typical *oxytropis* as ever.

5) The specimens from Hirobuchi Swamp, Prov. Rikuzen, show abundance of transitional forms, typical *oxytropis* into var. *Sclateri*, while the tendency to change into var. *japonica* is indicated only in a slight degree. In all cases, embryo-shells have the shape of the typical species.

6) Finally, the specimens collected at Kogawara Swamp, Prov. Rikuchu, are of great interest in that they serve for definitely settling the question as to the mutual relationship of the three forms. The young have invariably the shape and characters of typical *oxytropis* (figs. 8—11). Among the adults the *Sclateri* form prevails. There are besides unmistakable *japonica* form and others that combine the charac-

ters of the typical *oxytropis* with those of either *Sclateri* or *japonica.* Adults with the characters of typical *oxytropis* are not found in this lot.

In fig. 14 I have represented a specimen from this locality, which must certainly be considered as *Sclateri.* In its general shape, the form of the aperture and the nature of raised lines, it tallies well with the description and figures given by KOBELT of that form.

Fig. 17 represents a specimen from the same locality, which is a true *japonica* characterized by outbulged whorls, by the expanded outer lip of the aperture and by the partial absence of raised lines. The young specimen drawn in fig. 9 was taken from this individual.

As examples of varieties with combined characters, I have given figures of three specimens in figs. 13, 15, and 16. Both the specimens of figs. 13 and 16 have almost the shape of *Sclateri,* but at the same time approach *oxytropis* in the character of raised lines, which is especially the case with the specimen of fig. 13.

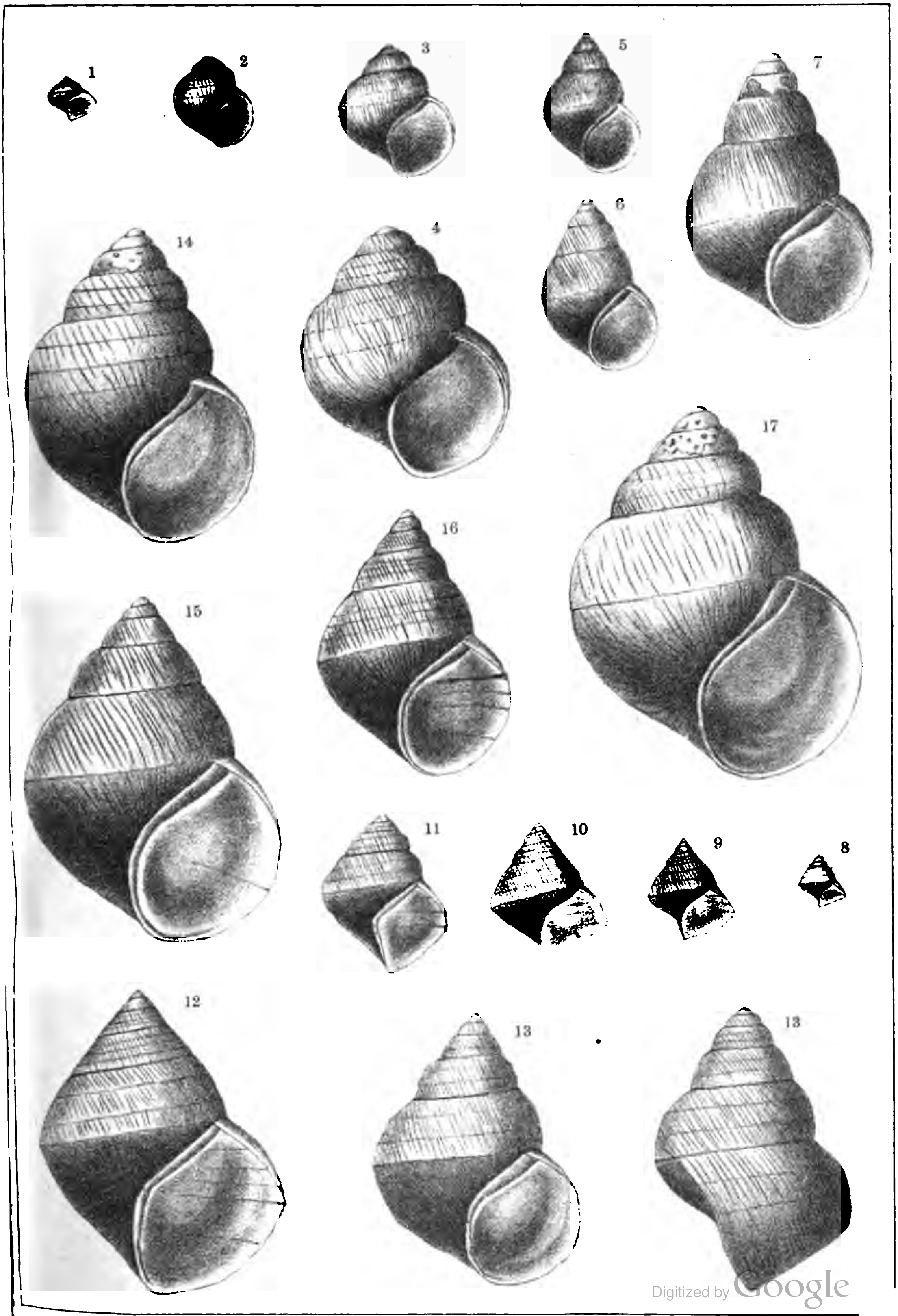
The individual of fig. 15 is nearly *oxytropis* in its general shape, but the raised lines have all disappeared except one on the body-whorl, in which respect it is like *japonica.*

I wish to emphasize once more that the young of all the varieties above mentioned are essentially *oxytropis* in character, so that figs. 8—11 might pass as young stages of any one of them. Here is, I think, a sufficient ground to conclude that *Pal. oxytropis* represents the ancestral species whence the several varieties have arisen.

EXPLANATION OF FIGURES.

Fig. 1—3. Three young stages of *Pal. stelmaphora* from Shariki, Prov. Mutsu.
4. An adult form of ditto.
5—6. Two young stages of *Pal. ingallsiana* from Suwa Lake, Prov. Shinano.
7. An adult form of ditto.
8—11. Four young stages of *Pal. oxytropis* from Kogawara Swamp, Prov. Rikuchu.
12. *Pal. oxytropis*, a typical form from Yamagata, Prov. Iwashiro.
13—16. Two intermediate forms between *oxytropis* and *Sclateri* from Kogawara.
14. *Pal oxytropis* var. *Sclateri* from ditto.
15. An intermediate form between *oxytropis* and *japonica* from ditto.
17. *Pal. oxytropis* var. *japonica* from ditto.

Printed July 22, 1897.



T. Iwakawa. del.

Dendrocoryne, Inaba, Vertreterinn einer neuen Familie der Hydromedusen.

Von **Seitaro Goto.**

Zoologisches Laboratorium der Ersten Hochschule in Tokio.

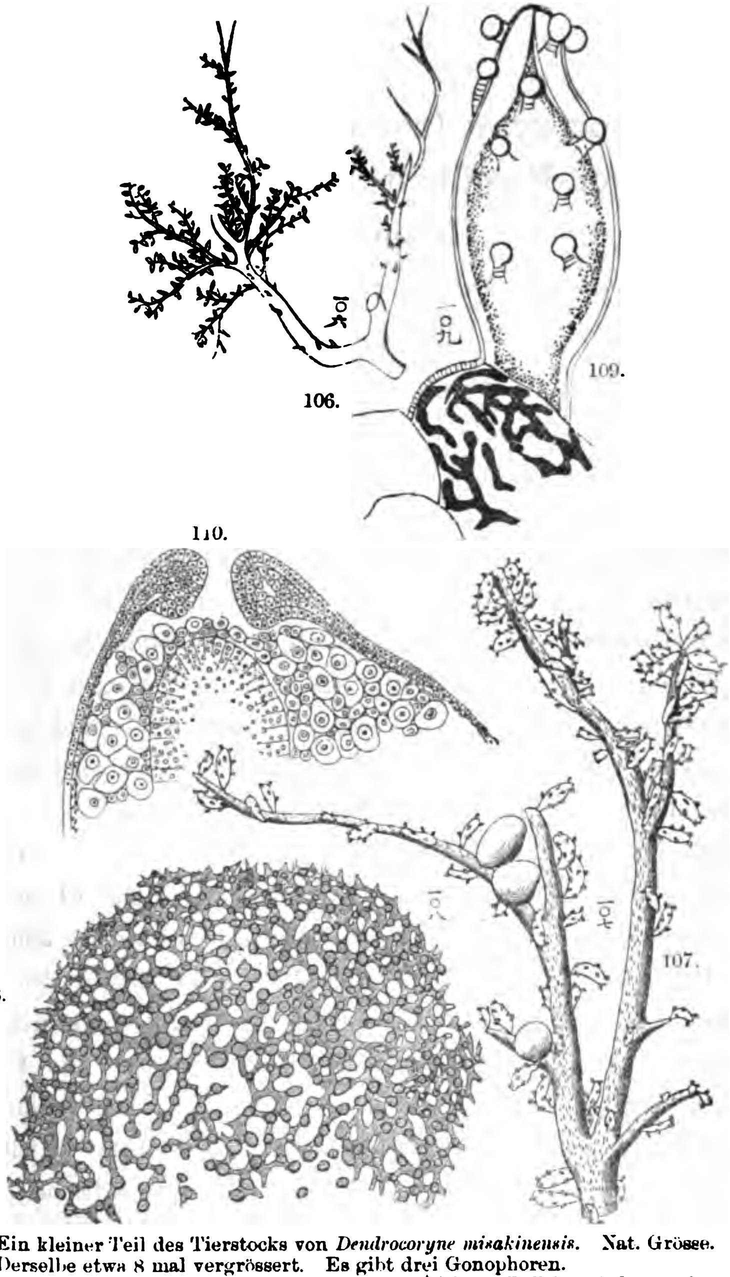
Hierzu Taf. VI.

Als ich im vorigen Herbst eine Umordnung meines Laboratoriums unternahm wurde ich einiger Exemplare der Hydromedusen gewahr, die mir so merkwürdig erschienen, dass ich sie bei Seite stellte, um sie nachher einer näheren Untersuchung zu unterziehen. Auf weiterem Studium der Literatur fand ich dass diese Hydromedusen schon vor einigen Jahren und zwar 1892 von meinem Freund Herrn Masamaru Inaba beschrieben worden sind. Da seine Beschreibung aber japanisch geschrieben in unserer „Zoological Magazine" verborgen bleibt, so möchte ich mit Bewilligung des Verfassers eine Uebersetzung derselben mit den Originalfiguren voll anführen, und dann einige eigene Beobachtungen mitteilen.

„36*. Gen.? sp.? (Figg. 106–110.)

„Trophosom—Der Tierstock erreicht in der Höhe 10 cm. oder mehr, Verzweigung unregelmässig, die Zweige sind aber mehr weniger in einer Ebene angeordnet. Das Chitin bildet nicht eine oberflächliche Schicht sondern ein Innenskelett von feinem netzförmigem Gerüst. Die dünnere Zweige stellen im Querschnitt einen Kreis dar. Die Polypen kommen zerstreut vor und wachsen unmittelbar aus dem Stamm hervor, ohne besonderen Stiel, spindelförmig. Tentakeln kugelförmig verdickt an der Spitze, 16–20 zerstreut an der Körperoberfläche.

* Diese sowie die folgende Nummer bezieht sich auf die Reihenfolge der aufgezählten Arten in der Originalarbeit, deren Titel folgendermassen lautet: Sōshū Miura Misaki Kinbō ni oite etaru Hydroidea (Die in Misaki, Miura, Sōshū, und seiner Nachbarschaft gesammelten Hydroiden), und welche in Bd. 4 (No. 41) der „Zoological Magazine," Tokyo, veröffenlicht worden ist.



106. Ein kleiner Teil des Tierstocks von *Dendrocoryne misakinensis.* Nat. Grösse.
107. Derselbe etwa 8 mal vergrössert. Es gibt drei Gonophoren.
108. Querschnitt eines dünnen Zweiges; nur der chitinöse Teil ist wiedergegeben. Zeiss 2 aa.
109. Spitze eines dünnen Zweiges; nur ein einziger Polyp ist eingezeichnet; man sieht das chitinöse Netzwerk an der Oberfläche des Zweiges. Zeiss 2 AA.
110. Längsschnitt eines weiblichen Gonophors. Zeiss 2 CC.

„Gonophor—Medusoide, nie freischwimmend, mit einem kurzen Stiel aus dem Stamm hervorwachsend; länglich ellipsoidisch, 2 mm. lang. Das Ostium ist nicht deutlich, seine Stelle jedoch ist durch vier rundliche Körper bezeichnet. Das Manubrium nimmt den ganzen Innenraum der Umbrella für sich in Anspruch. Das Obige bezieht sich nur auf das weibliche Gonophor; das männliche ist noch nicht bekannt.

„Farbe—Chitinöser Netzteil braun, Polypen und Gonophoren farblos.

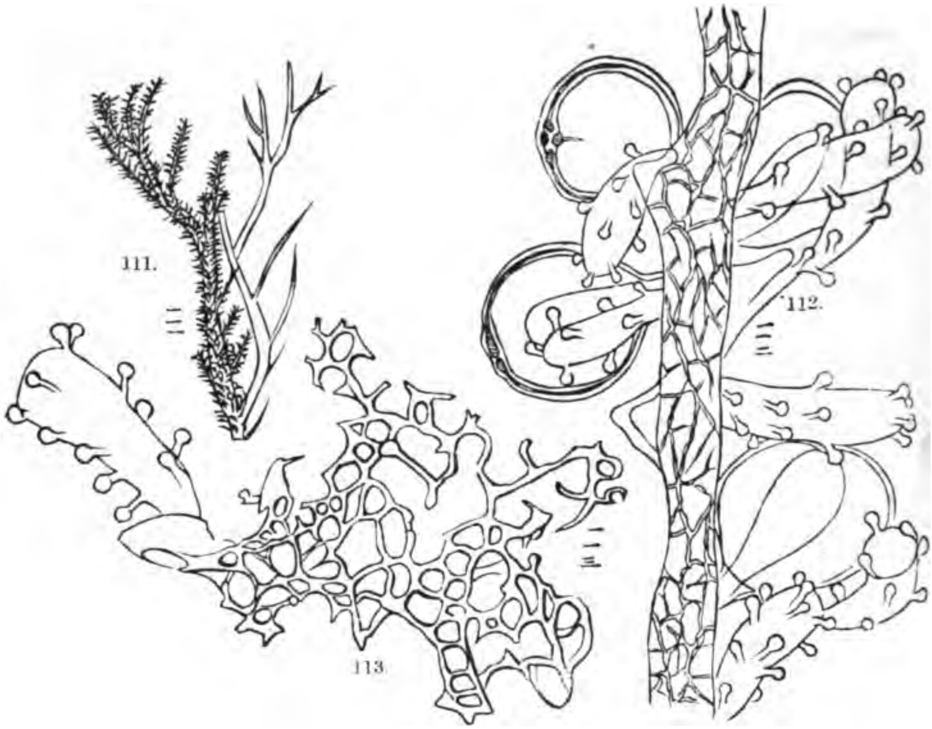
„Fundort—Westlich von Misaki, auf den Steinen wachsend, aus der Tiefe von etwa 6–7 Metern.

„Datum—Januar 1889.

„Diese sonderbare Hydroide wurde bisher mehrmals gesehen worden, aber man hat sie als eine Art von Actinozoen angesehen. Als ich aber dieselbe näher zu betrachten kam fand ich zu meinem Erstaunen dass sie eine wahre Hydroide ist. In den Werken von ALLMAN, HINCKS u. a. habe ich eine der vorliegenden Art etwa nahe stehende Form nicht ausfindich machen können. Meines Erachtens stellt sie vielleicht eine neue Art von einer neuen Gattung dar. In Misaki aber kommt eine zweite, naheverwandte Art vor; ich werde zunächst auf deren Beschreibung übergehen und dann einige allgemeine Bemerkungen über beide vorlegen.

„37. Gen.? sp.? (Figg. 111–113.)

„Trophosom—Der Stock erreicht in der Höhe 10 cm. oder mehr, Verzweigung unregelmässig, die Zweige sind aber sämtlich in einer Ebene angeordnet. Das Chitin bildet ein Innenskelett von feinem netzförmigem Gerüst. Die Zweige sind meistens plattgedrückt, und auf ihrer Oberfläche kommen der Länge nach verlaufende vorspringende Rippen und stumpfe dolchförmige Fortsätze vor. Die dünneren Zweige stellen im Querschnitt ein plattgedücktes Viereck dar. Von der Nähe der dolchförmigen Fortsätzen springen nach der Seite hin Polypen hervor; sie sind mehr weniger cylindrisch, schlank, und besitzen zerstreut an ihrer Oberfläche an der Spitze kugelförmig verdickte Tentakeln, die in Zahl 20 nicht übersteigen, und von denen 4 oder 5 einen Ring um den Mund bilden.



111. Ein Teil des Tierstocks von *Dendrocoryne secunda*. Die Polypen sind von einem Teil weggelassen. Nat. Grösse.
112. Derselbe; es gibt männliche Gonophoren. Zeiss 2 AA.
113. Querschnitt eines dünnen Zweiges; nur der Chitinteil ist wiedergegeben; ein Polyp ist in seiner natürlichen Lage eingezeichnet. Zeiss 2 AA.

„Gonophor—Medusoide, nie freischwimmend, wachsen meistens aus den Axillen der Polypen hervor, mit einem kurzen Stiel versehen, kugelrund, die vier Radialkanäle deutlich; die an deren Gipfel befindlichen vier rundlichen Körper sind auch deutlich und treten aus der Oberfläche hervor; das Ostium kommt niemals zur Ausbildung; das Manubrium nimmt den ganzen Innenraum der Umbrella in Anspruch. Das Obige bezieht sich nur auf das männliche Gonophor; das weibliche ist noch nicht bekannt.

„Farbe—Chitinteil braun; Polypen farblos.

„Fundort—Westlich von Misaki, auf den Steinen wachsend, aus der Tiefe von 6–7 Metern.

„Datum—Juli 1889.

„Ich hegte den Zweifel ob diese und die vorhergehende nicht ein und dieselbe Art bildeten, aber nach näherer Beobachtung wurde ich davon gewahr dass es nicht so ist. Die Fortpflanzungszeit für die erstere ist als Januar angegeben, aber nach dem mir vorliegenden Exemplar zu urteilen ist die Fortpflanzungstätigkeit zu dieser Zeit schon etwas abgewachsen, die Zeit der regsten Fortpflanzung ist also wahrscheinlich October bis November. Für die zweite Art ist die Fortpflanzungszeit dagegen Juli. Andere Unterschiede zwischen den beiden Arten kommen in der Verzweigungsweise des Tierstocks, in der Form der Polypen, im Bau des Chitingerüstes und in der Form der Gonophoren zum Ausdruck.

„Das Gonophor der ersteren Art ist ellipsoidisch, das der zweiten kugelrund; auch die Radialkanäle sind bei den beiden nicht gleich deutlich; da aber bei der einen Art nur das weibliche Gonophor mir vorliegt, bei der anderen dagegen nur das männliche so ist seine Formverschiedenteit wohl auf die des Gesehlechtes zurückzuführen. Der Polyp ist spindelförmig bei der einen, cylindrisch bei der anderen. Die Verzweigungsweise des Tierstocks ist sehr verschieden; bei den beiden ist die Verzweigung unregelmässig, aber bei ber zweiten Art sind die Zweige in einer Ebene angeordnet, so dass die Verschiedenheit der beiden Arten in dieser Beziehung sogleich bemerkbar ist.

„Zuletzt will ich den Chitingerüst besprechen. Derselbe besteht aus Fäden, von denen die longitudinalen resp. die transversalen einander nahezu parallel verlaufen. In den Maschen liegt der weiche Gewebe. Das Chitinskelett ist überall vorhanden, so dass es seine Eigengestalt nicht verlieren würde, selbst wenn man den weichen Gewebe entfernen sollte. Ueber die Anordnung der beiden Korperschichten kann ich nichts mitteilen. Meiner Meinung nach gibt es zu äusserst eine Ektodermschicht wie bei *Podocoryne* und *Hydractinia*, wie man teils in Fig. 109 ersehen kann. Die Maschen sind bei den beiden Arten grob im Achsen-

teil, und klein nach der Peripherie; bei der ersteren sind dieselben rundlich, wie in Fig. 108, bei der letzteren aber sind sie vieleckig (Fig. 113) und senden an der Peripherie dornförmige Vorsprünge aus.

„Fassen wir nun also den beiden Arten gemeine Charaktere zusammen: Der Stamm besitzt ein Chitinskelett, ist dendritisch verzweigt, sendet nach unten kriechende Wurzeln aus, mittelst welcher er am Substrat festsitzt; der sitzende Polyp ist mehr weniger spindelförmig, und besitzt zerstreut an seiner Oberfläche am Ende kugelförmig verdickte Tentakeln. Das Gonophor ist eine nie freischwimmende Medusoide, und besitzt vier Radialkanäle.

„Ich schlage für diese neue Gattung den Namen *Dendrocoryne* vor, und nenne die erstere Art (No. 36) *D. misakinensis*, die zweite (No. 37) *D. secunda*. Diese Gattung ist durch den Bau der Polypen und des Gonophors der *Syncoryne* am nächsten verwandt, aber das Chitinskelett scheint ähnlich wie bei *Podocoryne* angeordnet. Bei dieser bildet das Chitin eine dünne oberflächliche Schicht, bei der neuen Gattung aber ist es baumförmig; die Weise wie der Polyp von demselben vorspringt ist bei den beiden dieselbe. Bei *Podocoryne* ist das Chitinskelett röhrenförmig, bei *Dendrocoryne* dagegen ist dasselbe stäbchenförmig, was man nicht leicht vorübergehen darf."

Im in No. 42 der „Zoological Magazine" erschienenen Teil der obigen Arbeit fasst INABA die Gattungsdiagnose folgendermassen zusammen:

„Trophosom—Der Stamm ist verzweigt, besitzt ein inneres Chitinskelett, unten verbreitet, erhebt sich von fadenförmigen kriechenden Stolonen; Polypen sitzend, spindelförmig, und tragen zerstreut an ihrer Oberfläche am Ende kugelförmig veidickte Tentakeln. Gonophor—Medusoide, Umbrella tief, Radialkanäle vier, Randtentakeln vier, rudimentär."

Durch die Güte meines ehemaligen Lehrers, Herrn Prof. Dr. MITSUKURI wurde ich in den Stand gesetzt die von INABA gesammelten und im Museum des Zoologischen Instituts der Kaiserlichen Universität deponirten Exemplare zu untersuchen, und da INABA aus äusseren Gründen sich sehr wenig der Schnittmethode hat bedienen zu können scheint,

so glaube ich seine Berchreibung verbessern und einige Lücken darin ausfüllen zu können.

Was zunächst die äussere Gestalt des Tierstocks betrifft, so ist schon von INABA hervorgehoben worden, dass bei *Dendrocoryne secunda* alle Zweige in einer Ebene angeordnet sind. Dagegen scheint die Verzweigung bei *D. misakinensis* etwas unregelmässig: bei den im Universitätsmuseum befindlichen Spiritusexemplaren ist die Verzweigung fast nach allen Richtungen hin verbreitet nur mit mehr oder weniger accentuirter Neigung sich in einer Ebene anzuordnen; bei den im hiesigen Laboratorium befindlichen, sowie bei den im Universitätsmuseum befindlichen Trockenexemplaren aus Bonin Inseln, die ich als der *D. misakinensis* gehörend ansehe, sind dagegen alle Zweige nahezu völlig in einer Ebene angeordnet, wie bei *D. secunda*. Als Unterscheidungsmerkmale kommt jedoch einmal der Umstand, dass bei *D. misakinensis* einige viel dickere Hauptzweige von den übrigen unterschieden werden können, während bei *D. secunda* die Dickenverschiedeheit der Zweige bedeutend zurücktritt, wie man aus der Vergleichung der Fig. 1 u. 7 (Taf. VI) teilweise ersehen kann. Dann aber kommt noch der Unterschied in der Farbe der beiden Arten: bei *D. secunda* nämlich sindd er Chitinteil schwarzbraun, bei *D. misakinensis* dagegen weisslich braun. Bei den oben erwähnten Trockenexemplaren aus Bonin Inseln ist er zwar ganz schwarzbraun wie bei *D. secunda,* aber diess ist meiner Meinung nach entweder dem jahrelangen Trocknen zuzuschreiben oder doch wohl als Localvariation anzusehen. Was die Querschnittsbilder der Zweige anbetrifft so erscheinen sie mir so unregelmässig und so viel der Variation unterworfen dass man Unterscheidungsmerkmale der Arten daraus nicht entnehmen darf.

Die Polypen sind im ausgestreckten Zustand spindelförmig bei *D. misakinensis*; dagegen sind sie bei *D. secunda* stets cylindrisch.

Was den inneren Bau anbetrifft so bildet das Chitinskelett ein Gitterwerk, so dass man in Schnitten Bilder von einem Netzwerk bekommt. In einem Querschnitt eines Zweiges von *D. secunda* ist das Netzwerk überall fast gleich gebaut (Fig. 9); bei *D. misakinensis* kann

man aber drei Teile unterscheiden: einen Markteil (Fig. 3, *a*), einen inneren (*b*) und einen äusseren (*c*) Rindenteil. Im Markteil sind die Maschen gross und die Trabekeln ziemlich dick, im inneren Rindenteil sind die Maschen etwas kleiner und die Trabekeln am dicksten, im äusseren Rindenteil sind die Maschen klein und die Trabekeln sehr dünn. In Natur sind diese Unterschiede noch frappanter als in der Abbildung, da die verschiedene Dicke der Trabekeln eine ungleiche Absorption des Lichtes hervorruft. Die Maschen sind etwas eckig bei *D. secunda*, rundlich bei *D. misakinensis*, was jedoch nicht durchaus constant ist.

Gehen wir nun zur Beschreibung des weichen Teils. Die Stämme sowie die Zweige bis an die dünnsten sind zunächst nach aussen mit einer Ektodermschicht umkleidet, und der chitinöse Skelettteil befindet sich sämtlich nach innen von dieser; nur da, wo die Trabekeln nach aussen hervorspringen sind deren Aussenfläche bei *D. secunda* nur durch eine äusserst dünne Ektodermschicht begrenzt; bei *D. misakinensis* jedoch ist diese überall von ziemlich gleichmässiger Dicke. Innerhalb dieses ektodermalen Ueberzugs liegen der Chitinteil und die beiden Körperschichten, und zwar so, dass jedem Chitinstück zunächst das Ektoderm und innerhalb dieses das Entoderm. Dieses letztere stellt sich in Schnitten als rundliche oder verlängerte Röhren dar, und fällt sehr leicht in die Auge, da seine Zellen mit groben, etwas lichtbrechenden, ziemlich stark mit Hæmatoxylin sich färbende Körnchen erfüllt sind. In dünnen Schnitten, d. h. solchen wie man gewöhnlich mit dem Mikrotom sich bereitet, gehen die einen jeden Entodermring umgebenden Ektodermabschnitte verschieden in einander über, da in solchen Schnitten die einzelnen Maschen des Chitinskeletts nach dieser oder nach jener Richtung offen sind; in dicken mit freier Hand verfertigten Schnitten, wie sie in den Figg. 3 u. 9 wiedergegeben sind, wo jede Masche von ihren Nachbarinnen völlig getrennt sich darstellen, sieht man dass die den jeden Entodermringen gehörenden Ektodermabschnitte auch voneinander getrennt sich darstellen. Zwischen den beiden Körperschichten sowie zwischen den äusseren ektodermalen Ueberzug und dem nach

innen davon liegenden Teil liegt die Stützlamelle. Die Zellen des Ektoderms sind sehr arm an Cytoplasma: entweder sind sie stark vacuolisirt oder sie lassen grosse Intercellularräume zwischen sich. In und zwischen ihnen kommen zahlreiche Nesselzellen vor; dieselben sind bei *D. secunda* von besonderer Grösse.

Nach der vorhergehenden Beschreibung sieht man dass das weiche Gewebe unserer Tiere ein compactes Netzwerk bildet, ähnlich wie bei den Milleporiden, nur das Netzwerk ist bei unseren Tieren noch dichter als bei jenen. Das Skelett ist bei unseren Tieren chitinös, nicht kalkig.

In Fig. 10 sieht man die Anlage einer Knospe. Dieselbe bildet sich zwischen den chitinösen Trabekeln, und legt sich so an, dass zunächst das Entoderm sich nach aussen hervorstülpt und das Ektoderm davor weicht, wie bei der Knospung der Hydromedusen überhaupt.

An den Universitätsexemplaren von *D. misakinensis* finde ich die männlichen Gonophoren massenhaft. Dieselben sind kugelrund, mit einem sehr kurzen Stiel versehen, und besitzen einen medusoiden Bau (Fig. 5). Das Ostium kommt jedoch niemals zur Ausbildung, sondern bleibt durch die Stützlamelle stets verschlossen. Radialkanäle sowie der Ringkanal kommen nicht vor.

Die weiblichen Gonophoren von *D. misakinensis* kommen an den dem hiesigen Laboratorium gehörenden Exemplaren ziemlich zahlreich vor. Sie sind länglich ellipsoidisch und mit einem deutlichen Stiel versehen (Fig. 6). Das Ostium kommt zur Ausbildung; aber es giebt keine Radialkanäle, noch die Tentakeln, nur der Ringkanal ist ausgebildet, so dass man ohne Gefahr erschliessen darf, dass die weiblichen Gonophoren niemals vom Mutterstamm getrennt werden.

Von *D. secunda* kennt man z. Z. nur die weiblichen Gonophoren. Dieselben sind kugelrund, und mit einem sehr kurzen Stiel versehen. Das Ostium ist sehr eng; der Ringkanal ist wohl ausgebildet, aber soweit ich an dem mir vorliegenden, zwar nicht gut conservirten Material ausmachen kann, kommen keine Radialkanäle vor, was die Inaba'sche Angabe widerspricht. Das Velum ist ziemlich wohl ausgebildet, und die kurze Tentakeln kommen in der Vierzahl vor. Diese letzteren sowie das Velum sind sämtlich nach innen gerichtet.

Nach dem Vorhergehenden fasse ich die Gattungs- sowie die Artendiagnose folgendermassen zusammen:

Genus DENDROCORYNE, Inaba 1892.

Hydromedusen mit stark gebauten, reichlich sich verzweigendem Tierstock, dessen Chitinskelett ein Gitterwerk bildet und von einer äusseren Ektodermschicht überzogen ist. Polypen sitzend, cylindrisch oder spindelförmig; Tentakeln bis auf 20, an ihrem Ende kugelförmig verdickt, unregelmässig zerstreut am Körper. Männliches Gonophor soweit bekannt medusoid, kugelrund, geschlossen, ohne Radial- oder Ringkanal. Weibliches Gonophor kugelrund oder länglich ellipsoidisch, medusoid, mit Ostium und Ringkanal, sowie zuweilen mit Velum und rudimentären Tentakeln versehen.

1. *D. misakinensis*, Inaba 1892.

Tierstock reichlich nach allen Richtungen hin verzweigt, mit einer Neigung sich in einer Ebene abzuzweigen; mit einigen wenigen dicken Hauptzweigen, von denen die dünneren sich abzweigen. Polypen im ausgestreckten Zustand spindelförmig, von den Tentakeln 4—5 einen Kreis um den Mund bildend. Weibliches Gonophor länglich ellipsoidisch, gestielt, mit dem Ostium und dem Ringkanal versehen, ohne Radialkanäle. Männliches Gonophor kugelrund, geschlossen, mit einem sehr kurzen Stiel.

Chitinskelett äusserlich blassbraun, weicher wie bei der folgenden Art. Fundort—Misaki.

2. *D. secunda*, Inaba 1892.

Tierstock reichlich in einer Ebene verzweigt. Polypen cylindrisch, von den Tentakeln 4—5 einen Kreis um den Mund bildend. Weibliches Gonophor kugelrund, mit dem Ostium und dem Ringkanal, sowie dem

Velum und 4 kurzen Tentakeln versehen. Männliches Gonophor unbekannt.

Chitinskelett äusserlich dunkelbraun, stark gebaut.

Fundort—Misaki, Bonin Inseln.

Als ich Herrn INABA meine Uebersetzung seiner Originalbeschreibung zuschickte, wurde ich durch ihn darauf aufmerksam gemacht, dass die vorliegende Gattung vielleicht den 1868 von J. E. GRAY [1] als Schwämme beschriebenen und von v. LENDENFELD [2] den Hydractiniden zugezählten Gattungen *Dehitella* und *Ceratella* naheverwandt sei. In der Tat ist *Ceratella* äusserlich unserer *D. misakinensis* sehr ähnlich, *Dehitella* dagegen der *D. secunda*. Da aber die Entscheidung dieser Frage erst nach Vergleichung mit den Originalexemplaren möglich ist, so verschiebe ich diese auf eine monographische Arbeit über *Dendrocoryne*, die ich in Absicht habe.

Ich sehe unsere neue Gattung als Vertreterinn einer neuen Familie an, und schlage dafür den sachgemässen Namen: *Dendrocorynidae* vor.

Am Schluss möchte ich die Paleontologen darauf hinweisen, ob nicht der Bau jener alten Petrefakten, der Graptolitiden, im Lichte der Strukturverhältnisse des Chitinskeletts unserer Tiere besser verständlich werde.

1.) J. E. GRAY—Notes on the Ceratellidæ, a family of Keratose Sponges. Proc. Zool. Soc. London, 1868, p. 575—579.

2.) R. v. LENDENFELD—Ueber Coelenteraten der Südsee. V. Die Hydromedusen des australischen Getietes. Zeitschr. f. wiss. Zool., Bd. 41, 1885, S. 667.

TAFELERKLÄRUNG.

Dendrocoryne misakinensis.

Fig. 1. Ein kleiner Tierstock $^{1}/_{1}$.
2. Spitze eines dünnen Zweiges. $^{54}/_{1}$.
3. Ein Teil eines Querschnittes des Stammes; nur der Chitinteil ist abgebildet. $^{54}/_{1}$.
4. Ein kleiner Teil eines Querschnittes durch einen dünnen Zweig. $^{230}/_{1}$.
5. Schnitt durch einen dünnen Zweig samt dem darauf sitzenden männlichen Gonophor. Chitinteil schwarz, Entoderm dunkel schattirt, Ektoderm schwach schattirt. $^{86}/_{1}$.
6. Längsschnitt eines weiblichen Gonophors. Schattirung wie in Fig. 5. $^{54}/_{1}$.

Dendrocoryne secunda.

Fig. 7. Ein kleiner Teil des Tierstocks. $^{1}/_{1}$.
8. Spitze eines Zweiges. $^{54}/_{1}$.
9. Querschnitt durch einen dünneren Zweig; nur der Chitinteil ist abgebildet. $^{86}/_{1}$.
10. Ein kleiner Teil eines Querschnittes durch einen dünneren Zweig. $^{250}/^{1}$.
11. Längsschnitt durch ein weibliches Gonophor; Schattirung wie in Fig. 5. $^{86}/_{1}$.

Abgedruckt 27. Juli, 1897.


1
c
2
vel'n
5
6
sp'd'x.
ect.
chit.
ent.

On a New Species of Malacobdella (M. japonica).

By **U. Takakura.**

Zool. Institute, Imp. University, Tokyo.

With Pl. VII.

Since last April I have devoted myself to the investigation of a *Malacobdella,* which lives in the mantle cavity of *Mactra sachalinensis,* Japanese name, "*Ubagai*" or "*Hokkigai*", and have found out that notwithstanding a close resemblance of its external form to that of *M. grossa,* Müller, its internal structure presents some features sufficiently different from that of the latter species, to justify its separation into a distinct species.

M. japonica, as I propose to call our species, lives in the mantle cavity of *Mactra sachalinensis,* which is found in the northern part of our country. The specimen I used were all collected on the shore of Kujūkuri on the Pacific coast of the province Shimousa. Almost every individual of *Mactra* from that locality contains the parasite. Of the 56 shells, which I examined, 54 were found to be infected. As v. KENNEL found in *Cyprina islandica,* adult worms live always single in one shell, while if two or more live together in one shell these are invariably young individuals. Of the 54 shells, which contained the parasite, one was infected by 7, and two by 4, individuals which were all very young.

The longest specimen of *M. japonica* is about 45 mm. long and 4 mm. broad when fully extended, and the œsophageal region is broader than the posterior. When contracted, its length is reduced to nearly one-half, and the posterior part of the œsophageal region is slightly concave. The ground color is dark yellow.

In the epithelium are found flasc-shaped glandular cells, whose contents stain with hæmatoxylin. They are generally numerous on the ventral side, while they are often entirely absent on the dorsal surface and on the very tip of the head. Under the muscular layer of the body-wall in the anterior region, numerous groups of glandular cells are imbedded within the parenchymatous tissue. In most specimens, these groups are found in the œsophageal region, but sometimes they extend far behind that part. Generally they are found in a great number on the dorsal side. The ducts of these glands can not be clearly observed, but it seems probable that the streaks of fine granules, which are visible among the epithelial cells of the body-wall and which appear to have the same nature as the secretion of the glands, indicate their external ducts. At the anterior upper and lower edges of the mouth, their external ducts can distinctly be observed passing through the basal membrane to the exterior. In a greater part of the dorsal and ventral sides of the flattened lateral portion of the œsophageal region these glands are much developed, but few of them are met with in the anterior. Along the margins of such lateral portion, a voluminous aggregation of them is situated on each side, and their external ducts open at the lateral edge. These glands are abundant in the acetabulum as in *M. grossa*, especially on its ventral side.

The wall of the œsophagus is folded into finger-like processes, which v. KENNEL and others have already noticed; when fully extended they become rather slender, and those of the anterior part are protruded out of the mouth opening, and are moved to and fro like tactile organs. These processes, however, become short in the posterior and vanish in the narrow region, which connects the œsophagus with the intestine. The epithelium of the oesophagus is provided with a thin *tunica propria*, as BÜRGER observed, and the sub-epithelial glands are loosely imbedded on the outside of it, deeply within the body parenchyma. They are most numerous a little in front of the end of the œsophagus. The intestine, which is clearly distinguished by a narrow constriction from the œsophagus, makes about 10 windings, not

having diverticula. The anus opens dorsally nearly at the center of the acetabulum.

The rhynchocœlom of the present species differs greatly from that of *M. grossa* by being short (pl. VII, fig. 1). v. KENNEL says: the structure in the latter species "bis zum letzten Drittel des Köpers deutlich sichtbar bleibt," and "sondern jene (Biegungen des Darmes) manchmal schneidend bis gegen das Hinterende des Thieres hin, wo sie sich bei macroscopischer Betrachtung verlieren." BÜRGER remarks also: "Malacobdella ist mithin eine Angehörige der Holorhynchocœlomier." Thus in *M. grossa* it is obvious that the rhynchocœlom reaches the posterior end of the body, but the Japanese species is never a "Holorhynchocœlomier." The rhynchocœlom extends in the first two-thirds of the body and its posterior extremity is macroscopically distinctly observed. Different from *M. grossa*, a microscopical examination shows that it does not extend further backward than can be observed from the surface. It is slightly winding, being situated on the dorsal side of the digestive canal, but does not follow the curvature of the latter precisely (fig. 1). The proboscis, which has nearly the same length as the sheath, is distinguished into the anterior long glandular portion and the posterior short bulb-like cavity, followed by a strong retractor. The wall of the bulb is much thinner than that of the anterior division. The inner epithelium consists of low cylindrical cells, without glandular elements, and is not "ganz flaches Pflasterepithel" as v. KENNEL noticed. The retractor muscle is a strong bundle of longitudinal muscle fibres, which reaches the hind end of the rhynchocœlom. Its posterior extremity not only reaches the narrow end of the latter, but passing through its wall enters the parenchymatous tissue surrounding it and is soon reduced in bulk. Of the termination of the retractor fibres of *M. grossa*, it is said that they, after passing through the end of the rhynchocœlom, rise dorsad to be affixed to the muscular body wall, but the case is quite different in the present species. Instead of proceeding dorsad, they bend rather ventrad, and no connection with the muscular body wall is observed, except their crossing the dorso-ventral fibres, and

they terminate freely in the parenchymatous tissue (fig. 2). BÜRGER noticed the undoubted existence of the proboscis nerves between both longitudinal muscle layers, but he did not enter into further detail. As far as my investigation goes, it is most probable that the " Bindegewebe mit zelligen Elementen," which is alluded to by v. KENNEL represents the nervous layer of the proboscis. It has no definite form as in other Metanemertini, and is sometimes swollen and sometimes constricted, and often gives off several processes between bundles of muscle fibres. Numerous oval nuclei are imbedded within, or in the peripheral part of, the granular looking substance, which would be the fibrous part of the nervous layer. Such granular portion presents similar appearances as the fibrous part of the nervous system and has the same affinity for hæmatoxylin or eosin.

The circulatory system shows very complex anastomoses, and approaches the condition described by BLANCHARD[1)] and HOFFMANN,[2)] yet differs from them in some points. In young specimens it consists of only three vessels, one dorsal and two lateral, as in other Metanemertini, and has already been noticed by several authors (fig. 1). The two lateral vessels are connected in the head by a transverse canal and joined in the anal portion to two branches of the dorsal vessel (fig. 1). The dorsal vessel arises anteriorly a little behind the ventral commissure of the brain, by the fusion of two branches from the lateral vessels. At this stage there is not yet any branch to be found. But in the adult, the circulatory system reaches a degree of complication never found in other nemerteans, by giving off numerous branches, which come to anastomose with one another, especially in the anterior region. Figs. 3, 4, and 5, which have been reconstructed from sections, show respectively the circulatory system in the œsophageal, the middle, and the anal region. The vessels invariably show a complex system of anastomoses and are very asymmetrical, although there seems to be a great deal of individual variation. The dorsal vessel (fig. 3, *d. v.*) does not appear to be

---

1) & 2). I have not had access to the works of BLANCHARD and HOFFMANN, but I gather the above from the references made by v. KENNEL.

derived directly from the laterals as in the young specimen, but there seems to be various interplaced canals. It gives off in its course several anastomosing branches of various sizes, and such branches are connected laterally to those, which are derived from the laterals and occupy the lateral portions of the body (fig. 3, *net. v.*). In the anterior and middle regions the vessel can more or less distinctly be discriminated from its branches by its position under the rhynchocœlom, though it is often obscured in the middle region, where it makes strong windings and have large branches. In the anal region, however, it is impossible to trace the vessel as a single canal as in the anterior region, for it becomes slender connecting canals, traversing between the two large vessels (fig. 5, *d. v.*) above the intestine, and does not take the median position. These two vessels are continuations of those which are observed in other portions on the side of the dorsal vessel, being fused together with the latter at several points (fig. 4, *d. v.*). Laterally these two vessels are continued to a network of small canals, situated in the lateral part of the body, as in the anterior part (fig. 4 & 5, *net. w.*). At the end of the body they are united into a single canal and the lateral networks nearly disappear. Such a single canal divides, however, into two, immediately in front of the anus, and each branch enters the acetabulum to communicate with the lateral of its own side, and forms two curved vessels (fig. 4, *ac. v.*), which run along the edge of the acetabulum. Besides the horizontal windings, the two large vessels above stated make in their posterior portion strong vertical undulations along the sides of the digestive canal, approaching very near the lateral (fig. 4, *l. v.*), which is situated on the ventrolateral edge of the intestine, yet there are only a few direct connections between the laterals and the large vessels in consideration. In the anterior region, some of the branches of the dorsal vessel always run among the muscular fibres of the proboscis sheath, and communicate at several points with the dorsal itself. These branches already exist in young specimens, whose vascular system is furnished with only a few anastomosing branches in the tip of the head. The

lateral vessels (*l. v.*) are generally recognized everywhere, by their greater sizes and paucity in branches except in the œsophageal region. They are situated on the ventro-lateral sides of the digestive canal, except in the head, where they gradually shift their positions dorsad and finally take the lateral position. In the œsophageal region, various anastomosing branches are separated off towards the outer and inner sides and spread in the flat lateral edges of the body. It is through these canals that they are indirectly connected with the dorsal vessel. At the tip of the snout, the numerous branches also form networks, which are posteriorly continued to those in the lateral edges. Some branches from the vessels form a canal system which occupies the ventral side of the body. In fig. 3, this ventral canal system is shaded. Sometimes ventral connections under the œsophagus join the canals of the opposite sides (*v. c.*), a fact hitherto not noted in Metanemertini. The system is connected in several points to that (not shaded in the figure) situated on the dorsal side. In the middle region, the lateral vessels have only a few branches (fig. 4, *l. v.*). Unlike those of *M. grossa*, they have no branch at the posterior region, and in the acetabulum no trace of a complicated vascular system, as described by v. KENNEL, is found.

Of the excretory system no essential difference can be detected in the present species, except that the external opening is not situated ventrally, but dorsally to the lateral nerve stem and opens at the dorso-lateral side of the body.

The peculiar feature of the nervous system is the position of the posterior commissure of the lateral nerve-stems. There is no trace of the anal commissure above the anus, but posterior to it, along the posterior margin of the acetabulum, a strong commissure is distinctly observed as shown in figs. 1 & 6 (*a. c.*). At the points, from which the lateral nerve-stems enter the acetabulum, they slightly become larger, as v. KENNEL observed, and between these points a slender commissure runs along the anterior side of the acetabulum (*ac. c.*). This

commissure gives off numerous branches internally and externally, and together with the several big twigs from the larger commissure innervate the acetabulum. The ganglionic cells are found in the larger acetabular commissure.

Thus the Japanese species of Malacobdella mainly differs from M. grossa by its short rhynchocœlom, by its possessing the acetabular, instead of an anal, commissure, and by some differences in the vascular system. These data, I think, are enough to separate the present species from *M. grossa.*

July 1897.

LITERATURE.

(1) V. Kennel—Beiträge zur Kenntniss der Nemertineu. Arbeit Zool.-Zoot. Inst. Würzburg Bd. IV, 1878.

(2) A. C. Oudemans—The Circulatory and Nephridial Apparatus of the Nemertea. Quart. Journ. Micro. Sci., Suppl., 1885.

(3) A. E. Verrill—Marine Nemerteans of New England and Adjacent Waters. Trans. Connect. Acad. vol. 8, 1893.

(4) L. Joubin—Les Némertiens, 1894.

(5) O. Bürger—Die Nemertinen des Golfes von Neapel, 1895.

EXPLANATION OF FIGURES.

AC. large acetabular commissure. *ac.c.* small acetabular commissure. *ac. v.* acetabular vessel. *an.* anus. *b.v.* blood vessel. *d. v.* dorsal vessel.

D'.V. large branches of the dorsal vessel. *in.* intestine. *l.v.* lateral vessel. *net. w.* net-work of canal system.

Oes. œsophagus. *Pr.* proboscis. *Rh.* Rhynchocœlom.

Ret. Retractor muscle of the proboscis.

Fig. 1. Dorsal view of young *M. japonica*.

2. Vertical section of the end of the rhynchocœlom.

3. Blood vessels in the head of the adult, reconstructed from sections; *Md* median line. The vessels on the ventral side are shaded.

4. Blood vessels in the middle region of the adult, reconstructed from sections.

5. Blood vessels in the anal region of the adult, reconstructed from sections.

6. Vertical section of the anal region, showing the acetabular commissures of the lateral nerve stems.

Printed July 25, 1897.

Fig. 2.

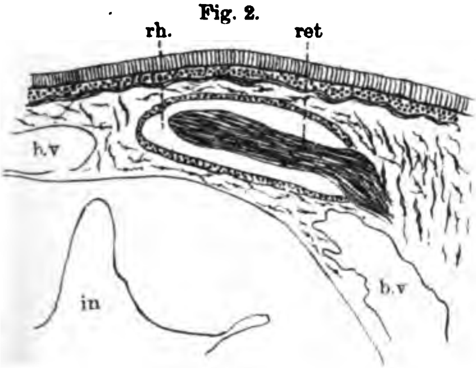


Fig. 3.

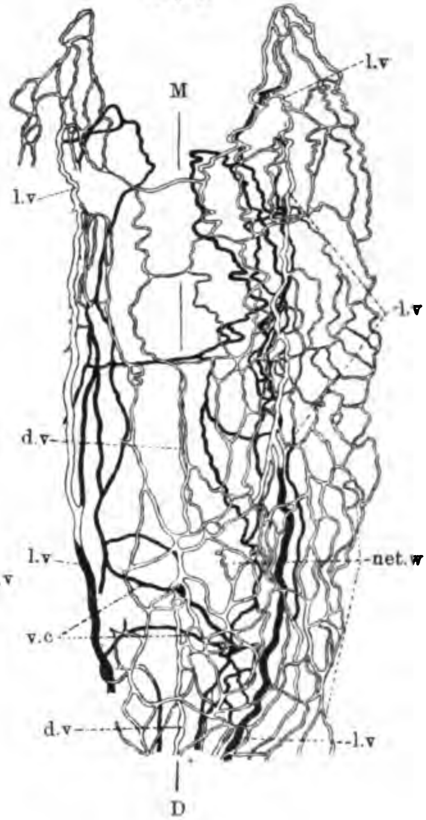


Fig. 5.

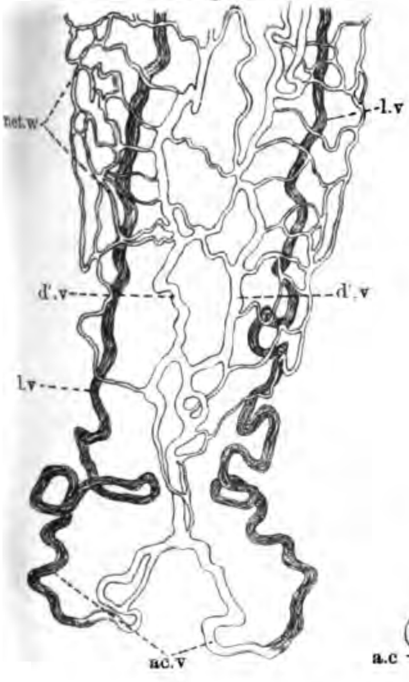


Fig. 1.

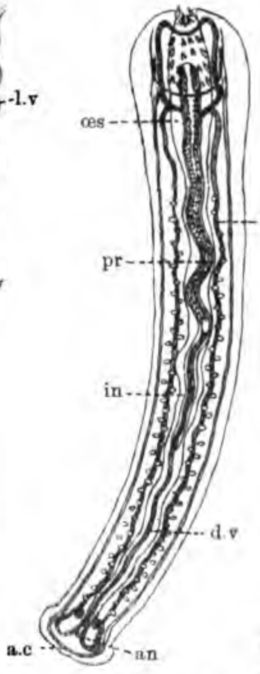


Fig. 4.

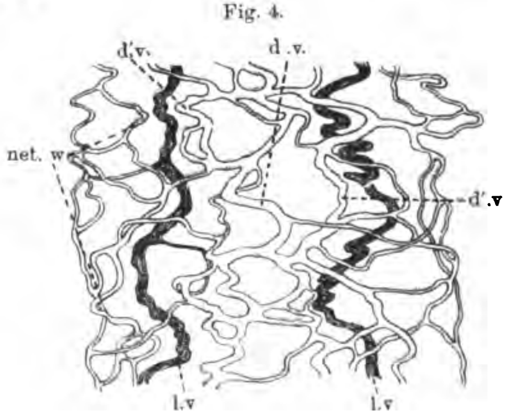
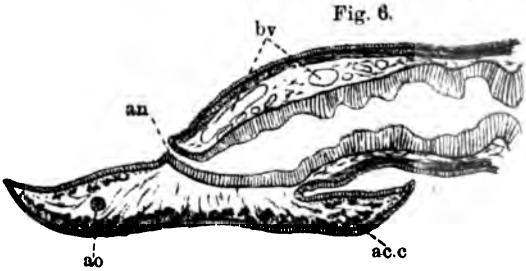


Fig. 6.



Notes on the Breeding Habit and Development of Racophorus Schlegelii, Günther.

By S. Ikeda.

Zoological Institute, Imp. Univ., Tokyo.

The breeding habit of one of our tree-frogs, *Racophorus Schlegelii*, Günth., present some remarkable features not known, so far as I am aware, in any other amphibia, and no apology, I believe, is needed for the publication of the following notes.

It is now thriteen years ago that my attention was first called to the peculiar breeding habit of this tree-frog. When I was travelling in 1884 through the Aizu district in the province of Iwashiro, I came one day across a pair of the tree-frogs depositing eggs in soft muddy ground covered with grass. The egg-mass was of a very peculiar appearance—it was a frothy mass, about 6 or 7 cm. in diameter, full of air-bubbles, looking exactly like well-beaten white of hen's egg. Pale yellowish eggs of the frog were scattered throughout the mass.

I have since been able to find in Tokyo the frothy egg-masses of the same species imbedded in wet and muddy banks of paddy-fields, ponds, etc. and to continue my observations on the breeding habit from year to year. Some of the results I have already published in the Tokyo Zoological Magazine in Japanese. It has, however, been only within the season just past that I have had the joy of ascertaining exactly how the frothy mass is produced. What is stated in the sequel have been compiled mostly from these observations made in Tokyo.

Pairing and Deposition of Eggs.

The breeding season of *Racophorus Schlegelii* extends from the middle of April to the middle of May, the exact time varying from year to year according to meteorological conditions. It seems most probable that a certain number of both males and females wake up from their hybernation on every warm day or night during the season, and soon pair on that day or the next. Therefore at such times we often find solitary individuals here and there in shallow waters of paddy-fields or ponds, some of these repeating a peculiar cry "*kro-kro-kro, kro-kro-kro.*" This is the sexual call of the males, which keep themselves hidden among grasses or in water and utter these notes elevating their heads a little.*

The females are always larger than the males. The length in the median line of the former measures about 5—6 cm., while the latter rarely exceed 3—4 cm. Once I came on a funny sight of a large female 6 cm. long pairing with a male of 2.5 cm. It seems probable to me that the selection of partners is done mostly during the day time and that towards the evening the female bearing the male on her back retires under ground to prepare for the deposition of eggs. If, however, the temperature should suddenly rise towards evening or during night after some cold days, then partners may be secured during the night, for at such times we often hear the sexual calls at night. After one or more cold days, it is difficult to find any animals either solitary or in pairs, or to find any fresh egg-deposit.

*This species has another call. In summer it utters a cry "*kiak-kiak-kiak, kiak-kiak-kiak,*" and this appears to me to be uttered by both males and females. The time and duration of the breeding season, and the sexual call of this species differ in many points from those of our *Rana* and *Bufo*. The breeding season of *Rana temporaria* is found in Japan to be a week or fortnight from the end of February to the beginning of March, and the tone of its sexual call is higher and longer than that of *Racophorus*. The breeding season of *Bufo japonica* is in the end of March or the beginning of April and lasts also a week or fortnight. Its sexual call is louder and higher but shorter. The pairing of *Bufo* is generally effected on warm nights or days during the season, on land, and then the animals go into water for the deposition of their eggs. The breeding season of *Rana rugosa* is in Japan, in the middle or the end of June, and goes on also a week or fortnight, and its sexual call resembles somewhat that of *Racophorus*, but is a little higher in tone.

The place where the partners retire to deposit eggs is always, so far as my certain observations go, in wet and muddy banks of paddy-fields, ponds, lakes, and the like. The spots chosen are generally along such a bank, at 10—15 cm. above the surface of the water, so that there is no fear of being washed by it. The site being fixed, the female digs in the muddy ground a spherical hollow 6—9 cm. in diameter. The inside of the hollow is made somewhat smooth by the movements of the female. Thus the animal that performs the chief work is the female who bears the male on her back, and moves round in the hollow, pressing its body against the wall. The hollow thus formed, the animals retire into it; and then it is entirely concealed under ground, being generally covered with grass. It is, therefore, very hard for one who is not well acquanted with the habits of the frog to find out such a hollow. The hollow is not, however, situated very deep under ground, and a part of the wall turned toward water is generally formed by a thin sheet of earth particles or dry mud, so that by boring through this part the animals may leave the hollow when they have finished the egg-deposition. The only way to find out such a hollow is to grope patiently by hand, along a bank which one thinks a favorable locality; when the hand goes into a hollow and comes in touch with the frothy egg-mass, a sort of gushing sound, which is produced by the crushing of the air-bubbles, is heard. The animals in the hollow are dark colored, different from the green color which they assume on trees or among dense grasses.

In general, when a night is warm, the animals sheltered as above finish spawning by the next morning, but if the night is cold, the egg deposition may be delayed and done either during the next day or at night, the latter, however, being much more frequent.

The foregoing account is sufficient to show that the deposition of eggs in this species takes place almost always during the night. It is probable that the selection of partners, the digging of hollows, and the deposition of eggs are all accomplished in a single day and night, after their awakening from hybernation.

When the deposition of eggs is finished, the pair separates and

Fig. 1.

each goes out of their hollow, leaving only eggs in it. Once or twice, I have seen the female alone remaining behind in the hollow. As to the mode of life after separation, *Racophorus Schlegelii* pursues one different from that of *Rana* or *Bufo*. The animals belonging to the latter genera go again under ground or into the bottom of deep water and there rest awhile, while the present species, after breeding, directly creeps out above ground and then goes upon the leaves or twigs of trees, uttering their peculiar summer call.

I have said above that the place selected for the deposition of eggs is, *so far as my certain observations go*, in wet and muddy banks of paddy-fields, lakes, and the like. I used the italicized clause advisedly, for there are indications of the animal depositing eggs in other localities. When living in my native province Echigo, I often noticed a species of green tree frog depositing its eggs between twigs and leaves of trees standing near water or among grasses growing near ponds, paddy-fields, etc. These eggs, I remember, were always enclosed in a frothy mass full of air-bubbles. My friend, Mr. M. KIKUCHI, tells me that he once saw a similar egg-mass on a shrub growing by the side of the pond in our University grounds in Tokyo. Mr. Y. TAKAHASHI, I am told, once noticed in the Hakone mountains a similar mass that was falling from a tree into a water-pool below. Some others of my friends have often found the same kind of frog-nests on trees in Nikko. One of the cases at the last mentioned locality has been described in an article entitled "Arboreal Tadpole" by an American naturalist, Mr. W. J. HOLLAND (American Naturalit, vol. XXIII, May 1889, p. 383), who expresses evident surprise at the peculiarities of the nest. Although I have not had opportunities of examining the frog in any of these cases, it seems very probable that all these frothy nests belong to *Racophorus Schlegelii*,

and that this species deposits its eggs under ground as well as on trees, shrubs, and grasses.

Egg-mass.

The eggs, when laid as stated above, are enveloped in a white jelly-mass full of air-bubbles, and of a spheroidal form. The surface of the mass is generally dirty from mud and earth particles adhering to it, while the interior remains pure white. The bubbles in the jelly mass vary in size, but are commonly 2—3 mm. in diameter, and are spherical in form. The snow-like appearance of this mass is entirely due to the presence of bubbles, as the fact that certain portions free from them remain transparent well proves, so that the comparison of such a mass to froth formed of well-beaten white of hen's egg is more than superficial. The newly laid mass is very elastic and tenacious, but with the lapse of time, it becomes gradually less elastic and less tenacious, so as to run down. The mass is then no longer able to keep its shape and flattens down gradually with the loss of air-bubbles in it, until finally it becomes so liquid as to flow out of the hollow into the water. By this time, the eggs have hatched into tadpoles, which are of course adapted to life in water. The outlet, through which the melted mass of the jelly runs down into the water, is the orifice previously made by the parents when they went out of the hollow through the thin portion of its wall above mentioned. This circumstance beautifully explains the reason why the egg-nests are never placed far from water. Both too much wetness and dryness seem equally injurious to the development of eggs. Those that have not yet hatched can never thrive in water, and if placed artificially in it by way of experiment, they soon die. On the contrary, I once saw some years ago, at Echigo, a nest of the species hanging down about 2 feet above water between the leaves of *Juglans Sieboldiana* (.Jap—*Onigurumi*) near the bank of a ditch; it was entirely dried up like a piece of dry bread, with many dead eggs in it.

What purpose does this frothy envelope of eggs serve? I am inclined to answer the question as follows :—

(1) It protects the eggs, mechanically, from external agencies.

(2) It perhaps prevents the eggs from too much crowding.

(3) It is made especially, as I think, to facilitate the respiration of the eggs and embryos in their early developmental stages.

The first of these points is very obvious. The jelly-mass around the eggs of *Bufo*, *Rana*, *Salmandra*, and the mass around the separately deposited eggs of *Triton*, must all serve the same protecting purpose. Small air-bubbles must act in this case as a sort of cushion, and are well adapted to protect the eggs out of water. As to the second point in *Bufo*, *Rana*, *Salmandra*, and others, in which eggs are deposited in groups in water, the jelly-mass around each egg absorbs water and swells up gradually, thus preventing the eggs from coming into contact with one another. In the present case, the mass of eggs being deposited under ground or in air out of water, the jelly can not swell up as much as in other cases, and it seems probable to me that the function of the air-bubbles within the jelly-mass is, in part, the means of preventing the eggs from too much crowding. The third point must surely indicate the chief purpose of this frothy envelope. The jelly-mass in this case is more liable to dry than those of the other amphibians, since it is not in water. And when the outer surface of the jelly-mass is dessicated and forms a crust, it effectually protects the inner part from further evaporation; but at the same time the inner part must necessarily be excluded from the external air—a condition which would cause the death of the eggs and embryos but for the presence of such air-bubbles as we see in this species.

Now comes the question: how is this peculiar frothy envelope produced? It is a question to which I have given much thought and attention, and the answer to which I have tried to find out every succeeding breeding season for some years past. All my efforts were baffled until last spring, when at last I was rewarded with success. The breeding season was somewhat backward this year, and on the afternoon of April 26, I found and brought home, besides some masses of eggs, a pair of frogs that were together in a hollow. This pair could not

have been long in the hollow, for the latter was not yet completed in some respects. Warned by previous failures, I placed the pair gently in an already prepared glass-jar and covered it with a piece of black cloth, allowing an observer to peep in only from two opposite sides. I took the jar on my table and sat watching the animals until eleven o'clock at night. But the animals were no doubt frightened by abnormal conditions and could not be induced to deposit eggs. On the next day (the 27th.), however, when I returned home at 6 P. M. I found that the animals had just begun spawning. The frothy mass was only about 3 cm. in diameter and contained about 20–30 eggs. The female was incessantly contorting her body. In order to watch these movements more satisfactorily, I lifted up slightly one end of the cloth-cover, but the instant I did so, the female ceased her movements and retreated into the frothy substance behind her. After these manœuvers were repeated two or three times on her part and mine, I boldly took away the cloth wholly from the jar. At first, the female hesitated, but after some time she began to deposit eggs, as if she did not mind light at all. Now, at last, my wish of many years standing was gratified and I could make exact obsevations.

The act of pairing in this species is not performed differently from other anurans, but the positions and movements of the hind limbs in both the male and female are very characteristic of the species. When the female is at rest, with the male on her back, the anterior part of her body is raised on the anterior limbs, but the posterior part of the belly lies flat on the floor and the loin is lowered so that the ventral margin of the cloaca comes into direct contact with the floor. The three portions (the femur, the crus, and the pes) of her hind limbs assume the following peculiar positions : the femur is directed anteriorly and externally, its lower surface (at least its proximal portion) touching the floor ; the knee is flexed as much as it can be, so that the crus comes to lie dorsally to the femur, and the ankle-joint is drawn on the back of the animal, on the side of the posterior part of the urostyle. The ankle-joint is also deeply flexed and the distal part of the pes touches

the floor. It is through the movements of the posterior limbs of the female that the frothy mass is kneaded and formed, but the parts moved are confined for the most part to the crus and the pes, the femur remaining comparatively still. The movements are not, however, by any means simple. Sometimes the knee and the distal end of the pes being fixed, the ankle-joint is moved backward towards the cloaca, just at the same time that it is flexed. Sometimes the ankle-joint is more or less straightened out and the crus and pes are thrown strongly backwards, the pes of the two sides often crossing each other. Corresponding parts of the two sides move simultaneously. The toes also perform an independent motion of their own ; they are strongly flexed, as if they were grasping some object. When any one of the motions is begun, it is generally repeated 5 or 6 times in succession, for about a minute. A rest of about half a minute follows a series of these motions, before another is begun.

Let us now see in what relation these motions stand to the production of the frothy envelope. While these motions are rapidly going on, the eggs together with the jelly-mass are gradually forced out of the cloaca, and are laid down on the bottom of the jar. When the ankle-joints or the crus and pes of both hind limbs are flexed backwards over the newly deposited jelly-mass, the latter easily adheres to the surface of the joints and of the pes, as it is very viscous. When the joints are again moved forwards to their positions on the back of the animal, the jelly adhering to them is pulled out as a thin transparent membrane stretching between the ankle-joints and the proximal part of the pedes of the two sides. When the joints are in the next motion again thrust backwards, the thin membrane is folded downwards and becomes a large vesicle about $^1/_2$—1 cm. in diameter, as the annexed woodcut shows. The air that forms the vesicle seems to enter from the sides, helped on by the grasping motions of the digits. These large vesicles are formed successively and carried back with each motion of the hind limbs. The large vesicles thus driven back are gradually broken up into smaller and smaller bubbles by the stirring of the crus and pes, when these

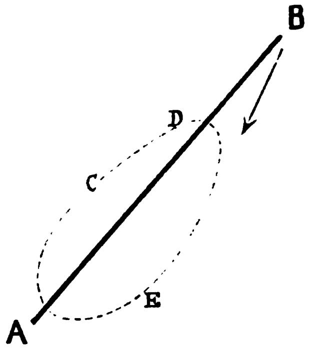


Fig. 2.
AB—a thin membrane seen in the sagittal section. A C D E—a vesicle produced by the folding of the membrane AB.

are thrust back. It may appear strange that these treading and kneading motions do not injure the eggs, but when we consider that they are covered over with highly elastic and tenacious jelly full of air bubbles acting as a sort of cushion, the safety of the eggs is not so mysterious as may appear at first sight.

The hind limbs of the male on the back of the female are bent in a vertical plane. The knee which is strongly flexed is inserted between the anterior margin of the femur and the sides of the belly of the female. The crus and pes are moved as a whole dorso-ventrally, thus stroking the pelvic portion of the female. This motion on the part of the male, it seems to me, is probably done in order to assist, by stimulation, the egg-deposition of the female. In some instances, however, another sort of motion was often gone through by the hind limbs of the male, in this way, viz. the hind limbs are withdrawn from the above mentioned position and soon thrown back, the crus and pes rubbing the dorsal face of the loin and cloaca of the female. Such a motion of the male hind limbs seems to me to be done to clear away the jelly particles adhering to the region in question of the female, which possibly interfere with the safe passage of the sperm-fluid.

Eggs and Embryos.

The eggs in the frothy mass differ more or less in size according to that of the mother animal, but in general they measure about 1 mm. in diameter, and are at first free from any pigment, which appears only later at the tadpole stage. The yolk pole is yellow, while the animal pole is merely pale and somewhat translucent. The very thin structureless yolk-membrane is closely applied to the egg, around which the jelly-

mass is devoid of bubbles and shows, to a certain extent, a concentric arrangement. The pigment appears first at the pectoral region of the hatched larva, as in the case of fish-embryos.

Segmentation on the whole is unequal and total, but *it shows a greater approach toward the meroblastic mode* than other amphibian eggs ; the first horizontal cleavage plane (3rd.) is placed nearer the upper pole and encircles a smaller area than in the eggs of *Bufo* and *Rana*. The first and second meridional cleavage planes may reach the yolk-pole, where they often cross with each other, but the subsequent meridional cleavage planes do not reach the yolk-pole and end mostly at about the equatorial region of the egg. Moreover at a later stage of development the first two meridional cleavage planes, which once reached the yolk-pole, become more and more insignificant up to the 32- or 64-cell stages, when they entirely disappear, together with some other cleavage planes in the lower hemisphere, while the cell outlines of the upper half are still distinctly visible.

The early development of the embryo is quite different from that of other amphibians, but *resembles very much that of the ganoid*, which is indeed the point that roused my great interest in the development of the animal several years ago, when I was studying the embryology of other amphibians under the direction of Prof. K. Mitsukuri. The chief points of resemblance with the ganoid are as follows : (1) the embryo is greatly flattened over the large yolk-mass, so that the ventrally observable organs, as the heart and the hyo-mandibular arches, appear in front and at the sides of the head ; (2) the body of the embryo, in later stages, is wedged into the yolk-mass, which is deeply grooved along the dorso-median line.

There are many other points which must be studied comparatively with the ganoid, the teleost, and other fishes. I have, however, not yet finished the microscopical study of these eggs and embryos. It is my earnest hope to be able to return to this subject at a later date.

Printed July 27, 1897.

Miscellaneous Notes.

Zoological Society of Tokyo.—The monthly meeting of the Society for April was held in the lecture room of the Zoological Institute of the Imperial University at 2 P.M. The President in the chair. The following papers were read:

Dr. KISHINOUYE on "a Trip to Tottori Prefecture." The author dwelt on the routes to this part of the country and gave a general account of its fauna.

Prof. SASAKI on "Pebrine." After giving a brief historical survey of previous works done on this disease of the silk-worm, in which he referred specially to those of PASTEUR and BALBIANI, he communicated the result of his own investigation as to the true nature of the micro-organisms that cause the disease. According to it those minute corpuscles that are found floating in the blood of the infected silk-worm represent only a stage in the life-history of an amoeba-like organism, in other words, those corpuscles are spores, thus confirming the result obtained by BALBIANI as opposed to that of PASTEUR.

The meeting adjourned at 3.30 P.M.

The monthly meeting of the Society for May was held at the usual place at 2 P.M. The President in the chair. The following papers were then read:

Mr. NISHIKAWA on "the Embryology of Caprella." The author gave a detailed account of the segmentation, gastrulation, and the formation of the mesoderm in a species of *Caprella* common in winter among *Sargassum* in Misaki, and compared them with the same processes in other crustaceans.

Prof. HATTA on "the Development of the Heart in Petromyzon." An abstract of this paper is promised in the next number of this periodical.

The meeting adjourned at 4 P.M.

The monthly meeting of the Society for June was held at the usual place at 2 P.M. The following paper was read:

Prof. MITSUKURI on "the Species of Holothurians manufactured

into *Kinko* * in Japan." The following species were enumerated: ***Mülleria mauritiana***, Quoy et Gaim., ***M. varians***, Sel., ***M. miliaris***, Q. et G., ***M. lecanora***, Jäg., ***M. formosa***, Sel., ***M. nobilis***, Sel., ***M. sp.***, ***Cucumaria japonica***, Semp., ***Stichopus japonicus***, Sel., ***St. sp.***, ***Holothuria monacaria***, Less., ***H. decorata***, v. Marenz., ***H. tenuissima***, Semp., and ***H. fusco-cinerea***, Jäg.

The New Imperial University of Kyoto.—By the Imperial Ordinance, No. 209, of June 18, a New Imperial University has been incorporated in Kyoto, with ninety professorships, forty-one assistant-professorships, and a provision for ninety assistants (Imperial Ordinance, No. 210). It is to consist of the four affiliated Colleges of Jurisprudence, Medicine, Literature, and Science and Technology. Only the College of Science and Technology will be opened next fall, and the chairs for it has been ordained to be twenty-one, distributed as follows: Mathematics 2, Physics 3, Chemistry 4, Civil Engineering 3, Mechanical Engineering 3, Electrical Engineering 2, Mining 2, Metallurgy 2. We thus see that the department of pure Natural History has been wholly left out; but we hope that this anomalous state of things will be but temporary, due entirely to financial deficiencies. We have every reason to believe that in a near future all the principal branches of modern science, whether pure or applied, will be fully represented by an adequate number of chairs; and we would suggest that when our science should be represented in the New University, a fresh water station on Lake Biwa would be a very fitting adjunct calculated no doubt to contribute much to the collecting of valuable informations as to the biological conditions of large bodies of fresh water, on which so much excellent work is being done both in Europe and America.

---

* Dried holothurians used for food.

PRINTED AT THE "TOKYO PRINTING CO., LD." TOKYO, JAPAN.

Notes on an Amphioxus obtained in Amakusa, Kyushyu.

By **H. Nakagawa.**

Biological Laboratory, 5th. Koto Gakko, Kumamoto.

It was in the middle of August, 1893, that I first dredged up several specimens of Amphioxus in Gosho-no-ura, Amakusa, in the province of Higo, Kyūshyu. Hitherto, Shika-no-shima (Shigajima) in the province of Chikuzen was the only place where Amphioxus could be obtained with certainty, but the number obtained there at a time is at the best very limited. In Gosho-no-ura, the case is quite otherwise; fifty or even a hundred may be got in the course of five or six hours. I have since visited the place five times, viz.—in November 1893, in April and November, 1895, and in June and July of this year. The animals thus obtained have been used from time to time for other purposes, but a certain number has been employed to make the observations herein recorded.

I. Collection.

The best time for collecting is from 9 A. M. to 3 P. M. on calm fine days. The animals live at the depth of six to ten fathoms in coarse shelly sand and are caught by means of a trawl.

II. Killing, Hardening and Preserving.

Picrosulphuric acid (sulphuric acid 2 parts and saturated aqueous solution of picric acid 98 parts) has always been used for killing and hardening. The reagent is added drop by drop to a flat-bottomed vessel containing the animals, with sea-water just enough to cover them, until no sign of life is shown by touching the body. Then they are put into picrosulphuric acid alone and allowed to remain for two or three hours.

To remove the acid, the specimens are passed through the ascending grades of alcohol and preserved finally in 90 %. Under this treatment not only the general outline of the body but the exact form of the fins are preserved, though the transverse diameter seems to be slightly diminished by contraction.

III. Size.

The length of the body was measured by placing the animals on a millimeter scale and carefully recording the space occupied between the tip of the snout and the posterior end of the tail-fin. The result of the measurements is shown in the following tables :

TABLE I.

Length in mm.	No. Spec.	Length in mm.	No. Spec.	Length in mm.	No. Spec.	Length in mm.	No. Spec.	Length in mm.	No. Spec.
54	1	41½	1	36	3	29	4	23	1
51½	1	41⅓	1	35½	1	28½	3	22½	1
50½	1	41	3	35	1	28	1	22	1
49	1	40½	2	34	1	27½	1	21	2
48½	1	40⅓	1	33½	1	27	3	20½	1
45½	1	40	2	33	1	26½	2	19	1
45	1	39½	2	32½	1	26	6		
44½	1	39	2	31	1	25½	1		
44¼	1	38	3	30½	1	25	4		
43	3	37½	3	30⅓	1	24⅓	1		
42½	4	37	4	30	1	24	2		
42	1	36½	1	29½	2	23½	1		

TABLE II.

♂				♀				Young.	
Length in mm.	No. Spec.	Length in mm.	No. Spec.	Length in mm.	No. Spec.	Length in mm.	No. Spec.	Length in mm.	No. Spec.
48½	1	35	1	49	1	33	1	10½	1
44½	1	34½	1	48	1	31	1		
43	1	34	1	44	1	30	1		
41	1	33½	1	40½	2	29	2		
40	1	32	1	40	1	26	1		
39	1	30½	1	38	1	25	1		
38	1	27	1	37½	1				
37	1	26	1	36	2				

Table I gives the measurements of the specimens obtained in November 1895, and Table II those in June of this year.

Thus the difference of the male and female in length is quite insignificant and the smallest specimen attaining sexual maturity is apparently 26 mm. in the male and 25 mm. in the female.

The average length of the body is 35.74 mm., the specimens less than 25 mm. in length being excepted.

IV. The Period of Sexual Maturity and Egg-Laying.

In the end of July and the middle of August, specimens containing fully-formed gonads are to be found very rarely, most of the specimens apparently wanting them altogether, and even in November they seem to be developing only in some of the large-sized ones. They attain a considerable size in April, but the sexes are only distinguishable in the middle of June (on the 11th. in the case noted), when all the specimens except the smallest one of only 10½ mm. in length (see Table II) contained full-sized gonads, the color being different according to the sexes, as will

presently be stated. The ova and the spermatozoa, however, are not yet fully ripe, for when these are subjected to examination the former are not separable from one another and the latter not uniformly developed. From these observations, it is quite evident that the period of active egg-laying must be between the middle of June and the end of July. The relation of the size of the animal to its sexual maturity, I have already stated above.

The color of the gonads is orange-red in the female and pale yellow in the male.

V. *The Number of Buccal Cirri and Branchial Arches.*

The buccal cirri were counted under the microscope by cutting out the margin of the oral aperture completely around and placing the cut-out part under a cover glass. To make out the branchial arches, the left side of the pharyngeal wall was dissected off and examined under the microscope. The results are given in the following table.

TABLE III.

Body length.	Total number of segments.	No. of branch. arches on the left side.	No. of cirri on the right side.	Median cirrus.	No. of cirri on the right side.
46 ...	... 64 ...	...213 ...	... 19 ...	... 1 ...	... 20
37½...	... 64 ...	...183 ...	... 20 ...	... 1 ...	... 20
28½...	... 63 ...	...137 ...	... 20 ...	... 1 ...	... 20
26 ...	... 64 ...	...121 ...	... 20 ...	... 1 ...	... 20

The number of the buccal cirri is thus nearly constant—i. e. 20 on each side, but the number of the branchial arches varies, increasing with the growth of the body, as suggested by BATESON.*

* BATESON—Materials for the Study of Variation, p. 174, foot-note.

VI. The Position of the Tail-Fin, the Number and Distribution of Muscle-Segments, and the Formula for the Present Species.

The number of segments was always counted only on the left side. The segment in which the anterior end of the dorsal or ventral portion of the tail-fin commences was counted from behind forward.

In determining the position of the atriopore I have met with no little difficulty, but as the posterior end of the metapleural folds almost always corresponds with the hind margin of the pore, I have taken that end as the landmark for distinguishing the anterior and middle portions of the three regions into which the body may be divided. For the anterior limit of the posterior region I have taken that segment as the first which lies just behind the projecting lip of the anus. The following table shows the results of these observations.

TABLE IV.

Body length.	No. of segments in the anterior region.	No. of segments in the middle region.	No. of segments in the posterior region.	No. of segments behind the commencement of the dorsal end of the tail fin.	No. of segments behind the commencement of the ventral end of the tail fin.
Specimens possessing 66 segments in all.					
49 ...	... 38 ...	... 17 ...	... 11 ...	... 11 ...	... 17
37 ...	... 37 ...	... 18 ...	... 11 ...	... 13 ...	... 18
Specimens possessing 65 segments in all.					
48½...	... 38 ...	... 16 ...	... 11 ...	... 11 ...	... 17
44¼...	... 36 ...	... 18 ...	... 11 ...	... — ...	... —
42½...	... 37 ...	... 17 ...	... 11 ...	... — ...	... —
41½...	... 37 ...	... 17 ...	... 11 ...	... 13 ...	... 18
41⅓...	... 37 ...	... 17 ...	... 11 ...	... 12 ...	... 18
40 ...	... 37 ...	... 17 ...	... 11 ...	... 11 ...	... 17
39 ...	... 37 ...	... 17 ...	... 11 ...	... 12 ...	... 17
36½...	... 37 ...	... 17 ...	... 11 ...	... — ...	... —
36 ...	... 38 ...	... 18 ...	... 9 ...	... 13 ...	... 17
35 ...	... 37 ...	... 17 ...	... 11 ...	... 12 ...	... 17
33 ...	... 36 ...	... 17 ...	... 12 ...	... 12 ...	... 18
29½...	... 37 ...	... 17 ...	... 11 ...	... 11 ...	... 17

Body length.	No. of segments in the anterior region.	No. of segments in the middle region.	No. of segments in the posterior region.	No. of segments behind the commencement of the dorsal end of the tail fin.	No. of segments behind the commencement of the ventral end of the tail fin.
Specimens possessing 64 segments in all.					
54	37	17	10	12	16
45½	36	17	11	11	17
45	37	17	10	12	19
44½	37	17	10	11	17
43	37	17	10	10	16
43	37	17	10	11	17
42½	37	17	10	11	17
42½	37	17	10	11	17
42½	36	17	11	11	17
42	37	17	10	11	16
41	36	17	11	11	18
41	36	18	10	11	18
41	36	17	11	12	18
40½	36	17	11	12	18
40½	36	17	11	12	18
40⅓	37	16	11	12	18
39½	36	17	11	12	17
39	36	17	11	12	17
38	36	17	11	—	—
38	37	17	10	12	17
37½	36	17	11	12	17
37½	36	17	11	12	18
37½	37	16	11	12	18
37⅓	36	17	11	12	17
37	37	16	11	11	17
37	36	18	10	12	18
36	36	17	11	12	16
36	37	17	10	—	—
35½	37	17	10	11	17
33	36	17	11	11	18
32½	35	18	11	12	18
31	37	16	11	—	—
30⅓	36	17	11	12	18
26	37	16	11	—	—
10½	36	17	11	—	—

Body length.	No. of segments in the anterior region.	No. of segments in the middle region.	No. of segments in the posterior region.	No. of segments behind the commencement of the dorsal end of the tail fin.	No. of segments behind the commencement of the ventral end of the tail fin.
Specimens possessing 63 segments in all.					
50½...	... 37 ...	... 16 ...	... 10 ...	... 11 ...	... 17
43 ...	... 36 ...	... 17 ...	... 10 ...	... 11 ...	... 18
39½...	... 36 ...	... 17 ...	... 10 ...	... 11 ...	... 18
38 ...	... 35 ...	... 17 ...	... 11 ...	... — ...	... —
37 ...	... 36 ...	... 17 ...	... 10 ...	... 11 ...	... 17
34 ...	... 36 ...	... 16 ...	... 11 ...	... 12 ...	... 17
30½...	... 35 ...	... 17 ...	... 11 ...	... 11 ...	... 16
28½...	... 36 ...	... 17 ...	... 10 ...	... — ...	... —
Specimens possessing 62 segments in all.					
51½...	... 36 ...	... 17 ...	... 9 ...	... 10 ...	... 14

Thus the dorsal origin of the tail-fin is in 28 cases out of 48 at the dorsal end of the dorsal arm of the hindmost segment of the middle region, and in 13 cases at the same end of the foremost segment of the hind region, while in 6 out of the remaining 7 cases, it is 2 segments, and in the other, 4 segments, before the anterior end of the postanal region. The place where the anterior end of the ventral part of the same fin commences is in 20 cases 7 segments, and in 19 cases 6 segments, before the anterior end of the hind region, whereas out of the remaining nine cases, in five it is 8 segments, in three 5 segments, and in one 9 segments, before the same part of the animal. From these observations it is to be concluded that the dorsal origin of the tail-fin is in most cases 1 segment, and its ventral end 6--7 segments, before the hind section of the body.

By referring to Table IV it will be seen that the total number of the segments composing the left side of the body varies between 62 and 66, but in the majority of cases 64 seems to be the normal number, for that is the case in 46 specimens out of 58. And it is also to be noted that

the variation is not in accordance with the size of the animal, because one specimen of only 10½ mm. in length possessed 64 segments, while another of 51½ mm. had only 62.

As to the distribution of the segments into the three regions, it will perhaps be proper to seek its normal state among the specimens that possess the average number of segments. So by consulting the third section of Table IV the two cases, 36, 17, 11 and 37, 17, 10, are apparently most predominant, the former occurring 16 times and the latter 11 times among 36 cases. Hence the formula for the present species is

36 (37), 17, 11 (10)—64, 35.

This does not apply to any of the nine species mentioned in E. A. ANDREWS' paper*, but as I have at present no opportunity of examining the specimens belonging to the species given there, I can not say whether we have here a new species or whether it belongs to one of the nine, which has not been collected and examined in sufficient number.

August 17, 1897.

Printed September 15, 1897.

* An Amphioxus from Japan, Zool. Anz., No. 468.

On a New Species of Elasipoda from Misaki.

By **Prof. K. Mitsukuri.**

Science, College Imp. Univ. Tokyo.

Ilyodæmon Ijimai, sp. n.

This is by far the commonest of the holothurians found in the deeper parts of the seas about the Misaki Marine Station, exceeding greatly in number *Lætmogone violacea*, Théel which is next to it in abundance.

The definition of the genus *Ilyodæmon* given by THÉEL* is as follows :—

> Tentacles fifteen, rather large and non-retractile. The lateral ambulacra of the ventral surface with large pedicels, apparently disposed in a double row all along each side of that surface. The odd ambulacrum naked. The dorsal surface with a crowded series of very numerous, retractile, slender, rather long processes, disposed in three or four irregular, close-set rows all along each of its ambulacra. Integument with numerous wheels and dichotomously branched bodies.

The present species falls in well with this definition, excepting a single point. *Its calcareous deposits wholly lack dichotomously branched bodies.* The specimens in my possession are quite numerous, and not only do I fail to discover any dichotomously branched bodies in all the preparations which show other kinds of calcareous deposits beautifully, but there is not in any specimen any trace of larger and smaller white spots visible to the naked eye, which are stated by THÉEL to be present in *I. maculatus*, and to be caused by those bodies. In view of this fact, it

---

* Report on the Scientific Results of the Exploring Voyage of H. M. S. Challenger 1873-76, vol, IV, p. 84.

would be necessary to modify the last part of the generic definition as follows: "Integument with numerous wheels, sometimes also with dichotomously branched bodies."

The same point also separates off the present species at once from *I. maculatus*, Théel, the only species, so far as I can discover, known hitherto of the genus.

The main features of the species are as follows:—

Body elongated, of almost equal breadth throughout, being in largest alcoholic specimens 120–160 mm. long and 35–40 mm. wide, about 3–4 times as long as broad. Mouth anterior, subventral. Anus posterior, subdorsal. Tentacles fifteen, with large circular discoidal ends; on the whole, the ventral tentacles smaller than the dorsal. The odd ventral ambulacrum naked. Pedicels of each lateral ambulacrum 22–25, the alternate arrangement of pedicels in the inner and outer rows of each amlulacrun very obvious in some specimens, and hardly recognizable in others, the difference being probably due to the degree of contraction in alcoholic specimens. Processes of each of the dorsal amlulacra very numerous, conical, rather short, the longest about one-third of the width of the body, in about four rows, of which the inner two are sometimes distinctly separated by a space from the outer two. Back naked in the median dorsal interamlulacrum, with the exception of the genital process in the anterior part. Integument soft, sometimes thin, sometimes thicker and spongy (the difference being probably due to the state of preservation), more or less translucent, most so in fresh state, internal organs (especially light-colored organs like the generative organs) being visible from the surface. Calcareous deposits of two kinds; large wheels with six central rods and small wheels mostly with four central rods. Among the former, the largest are about 0.21 mm. in diameter and have about nine spokes (See Théel, *loc. cit.* pl. XXXVI, fig. 15). These grade off into those about 0.1 mm. in diameter and with about twelve spokes. Various stages of growth in the large wheels are visible, as given by Théel. The small wheels (See Théel *loc. cit.* pl. XXXVI, fig. 17) are 0.046–0.059 mm. in diameter. In them

the felly is narrower and the spokes (usually 12) are shorter. Large wheels are most numerous on the dorsal surface, and in the lateral pedicels. Small wheels are predominant in the ventral perisoma and in the dorsal papillæ. Arcuate or spindle-shaped spicules are present on the pedicels and tentacles.

Color.—In alcohol, white grey without any white spots. In fresh state, beautiful light violet with deeper tints on the dorsal papillæ, etc. A rather broad straw yellow streak on each side of the dorsal surface along and outside the outer series of dorsal papillæ, becoming fainter toward the front.

Habitat.—In all parts of the Sagami Bay and of the outer part of the Tokyo Bay in waters deeper than 250 fathoms. Specimens in the Museum of this Institute.

The above description shows that this species closely resembles *I. maculatus*, the only distinct points of difference being the entire absence of dichotomously branched bodies, and the comparative shortness of the dorsal papillæ. Compared with the measurements given by THÉEL, the wheels, large and small, seem also to be slightly larger in the present species. It is a fact worth noting that the two species of *Ilyodæmon* occur at about the same longitudes (between 120°—150° E) but are separated by about 20 degrees of latitude. Anatomical notes as well as some interesting facts relative to the growth of the animal I reserve for some future occasion.

I take great pleasure in naming this present species after my friend and colleague, Prof. Dr. IJIMA, in pleasant remembrance of many uncomfortable but fruitful days spent together on fishing boats on the Sagami seas and in appreciation of his great services in unearthing the treasures of those deeper parts.

Sept. 19, 1897.

Printed October 15, 1897.

Preliminary Note on the Development of the Pronephros in Petromyzon.

By **S. Hatta.**

Biological Laboratory, Nobles' School, Tokyo.

I have recently studied the history of development of the pronephros in *Petromyzon*, and the results arrived at throw, I believe, some light on this subject. I will enumerate the chief points obtained in the following pages.

1). In *Petromyzon*, the pronephros becomes apparent at a comparatively early stage, that is, the stage approximately corresponding to the early section of stage II in the list given by me*. When the metameric segmentation of the mesoblast in the anterier region of the body has been finished, we can distinguish, in each of a few somites in this part, a piece of mesoblast which lies between the proximal somatic and the distal unsegmented portion (the lateral plate). The component cells of this piece first assume the regular arrangement of a columnar epithelium, and the parietal row of them is a little elevated aganist the epiblast. It is this piece which develops, as the subsequent history teaches, into the pronephric tubules and the nephrostomes; I will, therefore, hereafter call it the *anlage of the pronephros*. All the *anlagen* of the pronephros are cut off, with the lateral plates, from the segmented portion of the mesoblast, and are still more thickened by the repeated multiplication of cells. These thickened parts, however, is never a solid knob: for they acquire a lumen as soon as the *anlagen* come into view. The lumina of the pronephric *anlagen* communicate, of course, with the body cavity, which is a mere fissure in the stage in question. The cells forming the the *anlagen* are high and columnar in shape, while the cells

* Hatta, S.—Contrib. to the Morph. of Cyclostom. I. On the Formation of the Heart in Petromyzon. Journ. Coll. Sci., Imp. Univ., Tokyo, vol. X, pt. II.

of both the somatic and splanchnic layers of the lateral mesoblast are of irregularly quadratic forms.

2). The first appearance of the *anlage* of the pronephros is observed in the region under the fourth somite; this is the first pair of pronephric tubules. The following pairs become pronounced one after the other. The distal end of these tubules become confluent by the multiplication of their cells and thus a direct connection is established among them. These connecting pieces together from the collecting duct (Sammelrohr of RÜCKERT or the anterior continuation of the segmental duct) of the pronephros.

3). When all the tubules have become developed, there are 6 pairs, the first of which contains no lumen, while all the remaining pairs soon acquire a tubular structure. The independent canalization of each tubule proceeds backwards and into the collecting ducts, and finally all the tubules and the duct on each side are set in free communication. Then the ducts shift toward the median line of the body; consequently each tubule takes a latero-ventral course, and the funnels themselves become open just ventrally.

4). The first pair of tubules does not develop further, and the second pair degenerates after a short existence, while the 6th. pair loses its connection with the duct. The disconnected tubules remain unchanged for some time, but finally they disappear.

5). The total number of persistent tubules is, therefore, six, i. e. three pairs, of which the second and third pairs are developed most vigorously. This fact would explain why certain investigators believe 3 pairs to be present, while we are told by some others that there exist 4 or 5 pairs. In later stages, the foremost pair of the three persistent tubules is in close contact with the posterior wall of the gill-chamber.

6) The tubules are prolonged and grow downwards, pushing their way into the body cavity, until the funnels almost meet with the cardiac tube. The proximal portion of the tubules also grows enormously and becomes coiled many times, so that the chest-cavity is at last filled up with the convolutions of the tubules and the cardiac tube.

7). In the anterior region, the segmental duct has every appearance of having been formed in the same manner by the thickening of the proximal margin of the lateral plates, as in the pronephros proper; the only difference is that the *anlagen* do not develop into tubules, but unite with each other to form the duct. Owing to a large quantity of yolkmass in the posterior region the process is here much delayed and somewhat modified: it is brought about by the multiplication of a few cells proliferated from the proximal margin of the somatic layer of the lateral plates. I have observed neither any trace of an epiblastic origin of the duct nor any free growth of its posterior end*. In a much later stage, the posterior extremities of the ducts open into the cloacal section of the enteric canal.

8). From early stages, there is a complete blood supply in the pronephros: the arterial blood comes from the dorsal aorta; the blood corpuscles are found scattered between the tubules, and are afterwards transformed into two pairs of glomi, the anterior of which soon atrophies. The venous blood is taken away by the cardinal veins which drain the pronephros from early stages.

From the facts mentioned above the following conclusions are justified: Both the pronephric tubules and the segmental ducts are purely organs of the lateral unsegemented portion of the mesoblast †; the somatic mesoblast as well as the other germinal layers have no share in their formation. The *anlagen* of the tubules follow, from their first appearance, the same segmental arrangement as the mesoblastic somites. The maximum number of the pronephric tubules formed is 6 pairs, of which the first, second, and sixth degenerate one after the other. The persistent tubules are, therefore, the third, fourth, and fifth, of which the third pair is not so well developed as the next

* I have observed a case in which mitotic cell divisions are taking place in that point of the epiblast, where the segmental duct lies in close contact with it; this subject will be explained in the full paper.

† For convenience's sake I divide the mesoblast into two portions the somatic and the lateral plates, and no more.

two. It is an interesting fact that the first and second pairs originate in the region where afterwards the gill-slits are formed, and they disappear when the latter come into view. In later stages, the third or foremost pair of persistent tubules is in close contact with the hind wall of the gill-chamber.

These facts bear a close resemblance with those in *Bdellostoma* as described quite recently by G. C. PRICE*. Hence we have a strong reason to believe that the pronephros of cyclostomata is homologous with the "*Nierencanälchen*" of Amphioxus as described by TH. BOVERI†, and that at the same time, the persistent tubules of *Petromyzon* are homologous with those of Selachia, Teleostei, Amphibia, &c.; the mesonephros does not seem to be a part of the pronephros, but it probably belongs to another series of excretory organs.

The full paper will appear in the next number of the Journal of the College of Science, Imp. Univ., Tokyo.

June 12, 1897.

---

* PRICE.—Development of the Excretory Organs of a Myxinoid, Bdellostoma Stouti, Lockington. Zool. Jahrb., Bd. X.

† BOVERI, TH.—Die Nierencanälchen des Amphioxus. Zool. Jahrb., Bd. V.

Printed October 15, 1897.

Sur une nouvelle espèce japonaise du genre Lucernaria.

Par **A. Oka.**

Laboratoire zoologique de l'école normale supérieure, Tokio.

Au cours de recherches zoologiques sur les côtes de la province de Nagato, l'an dernier, j'ai eu la bonne fortune de pouvoir recueillir une méduse appartenant au genre singulier des *Lucernariæ* dont aucun représentant n'a figuré jusqu'à ici dans la faune japonaise. Je n'en ai rencontré qu'un exemplaire, mais cet unique spécimen est intéressant non seulement par sa nouveauté dans notre pays mais encore par sa forme qui diffère plus ou moins nettement de celle de toutes les autres espèces du même genre. C'est pour cette double raison que j'ai cru utile d'en donner une courte description.

Description.—Comme chez toutes les autres *Lucernariæ,* le corps de cette méduse se compose de deux parties bien distinctes, le calice et la tige.

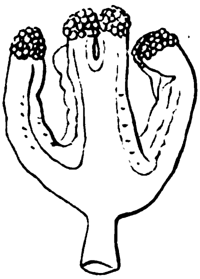


Fig. 1.

La tige, de forme cylindrique, courte, mesure 4 mm. de long et 2 mm. de diamètre. Le bout inférieur, qui est un peu dilaté, fonctionne comme une ventouse au moyen de laquelle l'animal se fixe.

Le calice, qui est la plus importante partie du corps, n'est aucunement cyathiforme comme on le trouve généralement chez les méduses de la famille des *Lucernariidæ.* Au contraire, il représente une croix grecque mince dont les bras sont divisés en deux à l'extrémité. On y distingue deux surfaces, une orale et une aborale, correspondant respectivement à la face interne et externe de la coupe. C'est au centre de la face aborale que le calice se joint à la tige,

Au milieu de la surface orale il y a un tube, assez court, le manubrium, à l'extrémité duquel s'ouvre la bouche. En coupe transversale ce tube est plus ou moins carré. L'extrémité libre en est quelque peu dilatée, la lèvre de la bouche montre beaucoup de plis gardant toujours un contour plus ou moins quadrangulaire.

Les bras de la croix sont lisses à la face aborale, où l'on ne trouve qu'une légère ondulation de la peau causée par la contraction des muscles situés directement au dessous. La surface orale, au contraire, présente deux élévations longitudinales s'étendant presque jusqu'au bout et separées l'une de l'autre par un sillon assez profond, d'où il resulte qu'en coupe transversale chaque bras donne le contour d'un B couché.

Fig. 2.

Près du centre de la croix, là, où les sillons atteignent les parois du manubrium,—car les angles de ce tube prismatique se trouve chacun en face de l'espace entre deux bras—il deviennent brusquement beaucoup plus profonds pour former ce qu'on appelle l'entonnoir septal. Là, les élévations que je viens de mentionner paraissent se toucher, formant chacune au point de jonction un angle droit avec son analogue du bras adjacent.

Comme je l'ai déjà signalé chaque bras se divise à l'extrémité en deux branches dont le bout distal est fourni d'une touffe de processus tentaculaires. Ces appendices, qui servent sans doute d'organe de succion quand le sujet cherche sa nourriture, sont chez notre exemplaire au nombre de 24 par touffe. Cette méduse possédant en tout huit touffes pareilles le nombre total de ses tentacules se monte à 192.

Le calice, étendu à plat, mesure 29 mm. de diamètre, chaque bras étant de 11 mm. de long sur 3 mm. de large. La portion où le bras est divisé en deux branches mesure environs 3,5 mm. Placé dans l'alcool le corps de cette méduse se réduit presqu' aux trois quarts de sa grandeur originale. Les bras se contractent plus que le reste. Ils se courbent en même temps en dedans et donnent alors à l'animal l'aspect caractéristique d'une *Lucernaria*. Quand il vivait, cependant, les bras

étaient si minces et si mous qu'on aurait pu les prendre à première vue pour des vers némertiniens.

Notre exemplaire qui se trouvait attaché sur une feuille de *Zostera marina* était, en état de vie, d'une couleur verte foncée imitant parfaitement celle de la plante. Je regrette bien de n'avoir pas déterminé d'où vient cette couleur qui disparait tres vite dans l'alcool. Grâce à cette ressemblance parfaite de couleur ce ne fut que par hasard que l'animal fut découvert, ce fait explique sans doute pourquoi il a échappé jusqu'à alors notre attention.

Habitat.—L'animal que je viens de décrire ci-dessus provient de Kogushi, petite ville de la côte occidentale de la province de Nagato, où je l'ai recueilli dans un dragage fait par 6–8 mètres de profondeur le 3 avril 1896.

Anatomie.—Pour étudier la structure interne de cette méduse j'en ai disséqué la tige et un bras.

La cavité cœlentérique, qui est continue partout, s'étend jusqu' au bout des bras. Dans chaque bras il y a un septum longitudinal qui divise cette cavité en deux moitiés latérales. La séparation, cependant, n'est pas complète, car à la base de la portion branchée se trouve au septum une petite ouverture par laquelle les cavités des deux cotés viennent à communiquer l'une avec l'autre.

Les glandes génitales forment huit rubans de contour irrégulier. Chaque ruban est composé d'un grand nombre de vésicules séparées, attachées en rang au plafond de la cavité du bras. Ce sont des glandes génitales qui causent les huit élévations que nous avons observées dans notre description de la surface externe du calice.

Les coupes minces montrent que la paroi du corps se compose de trois feuilles, l'ectoderme, l'endoderme et la membrane supportante. L'ectoderme couvre toute la surface externe du corps. L'endoderme revêt partout la cavité cœlentérique. La membrane supportante, gélatineuse et transparente, se rencontre entre les deux couches à toutes les parties du corps. Même la paroi des tentacules au bout des bras montre très nettement ces trois feuilles. Comme le représente la

figure 3 les glandes génitales sont situées entre l'endoderme et la membrane supportante.

FIG. 3.

La cavité du corps se prolonge jusqu'à la tige. Celle-ci est en somme uniloculaire, bien qu'à la périphérie sa cavité soit divisée en quatre parties par les quatre élévations très remarquables qui s'étendent du calice au bout inferieur de la tige. La figure 4 représentant une coupe transversale de la tige indique non seulement la forme de ces élévations mais encore l'étendue de la cavité interne.

FIG. 4.

Les fibres musculaires, qui se trouvent toujours dans la substance de la membrane supportante, se groupent en huit rubans s'étendant entre deux touffes successives de tentacules. Comme on doit le supposer d'après la configuration de la croix, ces rubans musculaires ne sont pas du tout d'égale longueur; ceux qui joignent les touffes au bout du même bras sont très courts, tandisque ceux qui s'étendent entre les bouts des deux bras sont naturellement beaucoup plus longs.

Il y a en outre un système de quatre rubans musculaires situés dans les septa longitudinaux des bras. Leur contraction courbe évidemment les bras en dedans, ce que l'on voit se produire subitement quand on jette l'animal vivant dans l'alcool.

À l'égard de l'orientation du corps de cette méduse nous somme portés, par comparaison avec des autres *Lucernariæ*, aux conclusions suivantes:

1. Les rayons sur lesquels se trouvent les septa sont Interradii, la petite ouverture dans les septa représentant le canal marginal des Acalephæ. 2. Les touffes de tentacules, ainsi que les glandes génitales sont, par conséquent, sur les Adradii. La forme en croix que présente le calice de cette méduse ne vient d'autre chose que de la suppression du développement sur les Perradii.

Remarques.—J'ai cherché vainement dans la littérature, dont je dispose, une forme qui serait identique à la nôtre. Il est donc fort probable qu'elle représente une espèce encore inédite. Toutefois, n'ayant pas pu consulter tous les mémoires publiés sur ce sujet, je n'insisterai pas sur ce point. Mais si la méduse que je viens de décrire se trouvait être nouvelle, je crois que le mieux serait de la designer sous le nom de *Lucernaria nagatensis.*

Le nom japonais que je propose pour cette méduse est celui de *Jūmonji-kuragé* (*Jūmonji*, croix; *kuragé*, méduse: méduse cruciforme).

Comme on le sait l'ordre des *Stauromédusæ* se divise en deux familles, *Lucernariidæ* et *Tesseridæ.* J'ai signalé ci-dessus l'existence sur nos côtes d'une espèce au moins de la première famille. Quant à la seconde, on connait déjà aussi une forme japonaise, dont le spécimen, également unique, a été recueilli il y a un peu plus de trois ans par mon collègue M. M. Inaba. On en trouve la description par M. K. Kishinouye, sous le nom de *Depastrum Inabai,* dans le numéro 61 du Zoological Magazine.

Le 10 oct. 1897.

Imprimé le 25 octobre 1897.

Sur une nouvelle espèce japonaise du genre Phoronis.

Par **A. Oka.**

Laboratoire zoologique de l'école normale supérieure, Tokio.

Grâce à l'amabilité de M. le Prof. I. IJIMA de l'Université j'ai pu examiner récemment une espèce indigène du genre *Phoronis*.

Nous connaissions depuis longtemps quelques formes larvales nommées *Actinotrocha*. Nous étions accoutumés à en rencontrer un grand nombre parmi les Planktons de nos côtes et il nous paraissait toujours inexplicable que l'animal adulte ne se montrât nulle part. Or, le savant zoologiste en a découvert, il y a un an, une colonie assez grande, composée de plusieurs centaines d'individus. C'est de cette colonie que proviennent les spécimens que je vais décrire ci-dessous. Chose étrange, on n'a, jusqu'au moment où j'écris, pas retrouvé cet animal.

On sait que la *Phoronis* habite la mer et que chaque individu de ce genre s'y construit comme demeure un long tube. Chez notre espèce ce tube est formé de matières chitineuses sécrétées par la peau de l'animal. La paroi en est très mince, hyaline, d'une couleur jaune très pâle; la surface est souillée d'une boue qui semble être faite des excrétions mêmes de l'animal. On n'y trouve jamais de sable.

Ces tubes qui sont 1 mm. de large, mais dont je n'ai pu déterminer la longueur, s'entrelacent formant un véritable feutre. L'épaisseur de ce dernier peut être de plus 40 mm. Un petit ascidien s'y trouvait complètement caché. Au centre de la colonie on compte de 10 à 15 individus sur 10 mm. carré.

Chez nos exemplaires, conservés dans l'alcool, le corps mesure, y compris la couronne tentaculaire, plus de 40 mm. de long et 0.5 mm. de large. À l'état vivant, il était, sans doute, plus grand. Au sujet de

la forme du corps proprement dit, ainsi que de la couronne, j'ai trouvé qu'elle ne fût en rien différente de celle du *Phoronis psammophila* décrit par M. I. CORI.*

Le nombre de tentacules était chez trois individus pris au hasard, de 145, 176, 138; soit d'environ 150 en moyenne. Les tentacules mesurent elles-mêmes 2 mm. de long.

La colonie a été recueillie, ainsi que me l'a communiqué M. le Prof. IJIMA, au mois d'août de l'année dernière, dans un dragage fait en rade de Moroïso, près de Misaki où se trouve notre station zoologique.

Nous ne connaissons à présent que sept espèces distinctes de *Phoronis* :

1. *Ph. hippocrepia*, Wright.
2. *Ph. australis*, Haswell.
3. *Ph. Buski*, McIntosh.
4. *Ph. Kowalevskyi*, Caldwell.
5. *Ph. psammophila*, Cori.
6. *Ph. architecta*, Andrews.
7. *Ph. Sabatieri*, Roule.

Les quatre espèces européennes, savoir *Ph. hippocrepia*, *Ph. Kowalevskyi*, *Ph. psammophila*, et *Ph. Sabatieri*, ainsi que l'espèce américaine, *Ph. architecta*, se distinguent très aisément de notre espèce en ce qu'elles ne possèdent que la moitié des tentacules qu'a cette dernière. D'autre part, *Ph. Buski*, est fournie d'environ 300 tentacules, c'est presque le double du nombre de notre espèce. Quant à la *Phoronis australis* il n'est pas besoin de la comparer avec la nôtre, car ses tentacules mesurant plus de 6 fois la longueur de celles de cette-dernière n'ont pas leurs pareilles parmi les espèces jusqu'ici décrites.

Notre animal ne répond donc à aucune des espèces connues et je crois être autorisé à en faire une nouvelle espèce, *Ph. Ijimai*.

* CORI, C. J.—Untersuchungen über die Anatomie und Histologie der Gattung *Phoronis*. Zeitschr. f. wiss. Zool., LI.

Imprimé le 25 octobre 1897.

Miscellaneous Notes.

The Occurrence of Sphærothuria bitentaculata, Ludwig in the Sagami Seas.—This curious and interesting holothurian, looking externally like some simple Ascidian was obtained in the seas near the Galapagos Islands by Prof. ALEXANDER AGASSIZ, while on the exploring expedition to those parts on the U. S. Fish Commission steamer "Albatross," and was described by LUDWIG in his report on the Holothurioidea of the Expedition (Mem. Mus. Comp. Zoöl., vol. XVII, no. 3) under the name given above. During the summer just past, I have been fortunate enough to obtain two specimens of this species in the seas near the Misaki Marine Station. One specimen was obtained about seven miles south of Misaki in what is known as the Uraga Channel at the depth of about 350 fathoms. The other was fished up about five miles west of Misaki in the Sagami Bay at about the same depth. Both were caught by a fishing long line and found attached to the jelly-mass which Bdellostoma secretes and hides itself in. The specimens on the whole tally well with the descriptions of LUDWIG. The occurrence of this rare species at two places separated from each other by the entire width of the Pacific is, to say the least, very interesting and goes once more to establish the comparative uniformity of the deep-sea fauna. The discovery of the animal at intermediate stations would not now be surprising at all.

K. MITSUKURI.

Contributions to the Morphology of Cyclostomata. I. On the Formation of the Heart in Petromyzon, by S. Hatta. Jour. Sci. Coll., Imp. Univ., Tokio, Vol. X, Pt, II, p. 225–237. Pl. XVIII.—Die erste Andeutung des Herzens findet man schon an sehr jungen Embryonen welche noch eine wenige Zahl der Mesodermsegmente und nur zwei Paar Kiemeneinbuchtungen besitzen. In diesem Stadium beobachten wir immer, zwischen den zwei primären Keimschichten zerstreut, eine Anzahl Zellen, die den Mesodermzellen ganz ähnlich aussehen. Dieselbe gruppiren sich besonders auf der Medianlinie des Bodens, vor jener Stelle, wo der weit ausgedehnte Mitteldarm sich mit dem schlanken Vorderdarm verbindet. Diese mesenchymatischen Zellen weichen nach einiger Zeit aus einander und bilden ein Rohr, indem sie sich epithelial anordnen. Dieses Gebilde welches unterdessen rechts und links von den beiden

visceralen Seitenplatten umschlossen wird, ist nichts anderes als das Herzendothel, während die letzeren die *Anlage* des Perikardiums darstellen. Das Herz hat nun, also, die Gestalt eines langen Epithelrohrs, welches von den mesenterialen Visceralhäuten an der Körper- und Darmwand suspendirt wird. Diese Suspensorien (Mesocardium anterius et M. posterius) erfahren, aber, kurz nachher eine Rückbildung, so dass das Herzrohr schliesslich frei zu hangen kommt. Im nächsten Stadium schnürt sich das Herzrohr, gleichwie die Perikardialhaut, in ihrer Mitte ein und wird in zwei konischen Hälften geteilt, von denen die vordere das Ventrikel und die hintere das Atrium darstellt.

Das Herzendothel bildet sich also nicht etwa durch die Delamination der visceralen Seitenplatten, wie A. SHIPLEY annimmt, sondern es verdankt seinen Ursprung einzig und allein jenen im ventralen Raume vor dem Mitteldarm befindlichen Mesenchymzellen. Was die Herkunft dieser Zellen, worüber die Ansichten der tüchtigen Embryologen auseinander gehen, betrifft, so kann ich unglücklicherweise nichts bestimmtes aussagen; da aber mehrere Mesodermzellen von den ventralen Kanten der Seitenplatten hinabfallen, bin ich geneigt anzunehmen, dass sich diese freigewordenen Zellen in jenem Raume zusammen gruppirt haben. Nach der Angabe A. SHIPLEY's tragen diese Zellen zur weiteren Bildung der Seitenplatten bei, wie ich sie auch schon in meiner früheren Arbeit bestätigt habe. Da in späteren Entwicklungsstadien, aber, mehrere mitotischen Figuren im eigentlichen Mesoderm selbst zu beobachten sind, scheinen die ventralen Partien des Mesoderms einzig und allein durch das Wachstum der Seitenplatten vervollkommnet zu werden, so dass die Zellen einer anderen Herkunft mit derselben nichts zu tun haben.

S. HATTA.

Zoological Society of Tokyo.—The monthly meeting of the Society for September was held in the lecture room of the Zoological Institute of the College of Science, Imp. Univ., at 2 P.M. Saturday the 18th. The first part of the meeting was occupied with the election of officers for the ensuing year. The following gentlemen were elected:

President.	Prof. I. IJIMA.
Secretary.	Mr. T. AIDA.
Librarian.	Mr. S. IKEDA.
Treasurer.	Mr. M. NAMIYE.

Prof. MITSUKURI then read a paper "On the Occurrence of *Sphærothuria bitentaculata*, Ludw. and *Ilyodæmon Ijimai*, sp. n. in the Sea of

Sagami." The substance of the paper is found elsewhere in the present issue.

Personal News.

Mr. JIUTA HARA has been appointed Professor of Zoology in the Agricultural College of Sapporo. His address hereafter will be Agricultural College, Sapporo, Hokkaido.

Dr. ASAJIRO OKA has removed as Professor of Zoology to the Higher Normal School of Tokyo. His place in Yamaguchi has been taken by Mr. MASAMARU INABA, hitberto in Mayebashi.

Prof. MITSUKURI has been delegated by the Imperial Government to the Seal Conference in Washington. After the Conference he will spend some months elsewhere in America and in Europe.

List of Publications received in exchange for the Annotationes until October, 1897, arranged alphabetically according to Authors or Societies.

ALLIS, E. Ph.—The Cranial Muscles and Cranial and First Spinal Nerves in Amia calva.

CARNOY, J. B., et LEBRUN, H.—La fécondation chez l'Ascaris mégalocephala.

Deutschen Gesellschaft für Natur- u. Völkerkunde Ostasiens, Mitteilungen der. Hfte. 1, 5, 9, 10, 11, 13, 46, 48, 49, 52, 59.

DUERDEN. J. E.—The Actinarian Family Aliciidæ.

HARTLAUB, Cl.—Beiträge zur Meeresfauna von Helgoland. X. Die Hydromedusen Helgolands. II. Bericht.

Jamaica, Journal of the Institute of. Vol. II, No. 4.

Manchester Microscopical Society, Transactions and Annual Report etc. of, for 1896.

Naturhist. Forening i Kjobenhavn, Videnskabelige Meddelelser fra den, for 1896.

Natuurkundig Tijdschrift voor Nederlandsch Indië. Deel LVI. Neg. Ser. Deel V.

Ditto, Alphabetisch Register van, op Deel I—XXX & Deel XXXI—L.

„ Naamregister van, op Deel I—XXX.

Nebraska, Calender of the Univ. of, for 1896–97.

North Carolina, Catalogue of the Univ. of, for 1896–97.

Novitates Zoologicæ. Vol. IV. Nos. 1 & 2.

Società Romana per i Studi zoologici, Bolletino della. Vol. VI, fasc. I e II.

Smithsonian Institution, Publications of. May, 1896.

SPENGEL, J. W.—Bemerkungen zum Aufsatz von N. NASSANOW über die Exkretionsorgane der Ascariden in No. 533 des Zoolog. Anzeigers.

WATTENWYL, C. B. v.—Monographie der Stenopelmatiden u. Gryllacriden.

WILDEMAN, E. de.—Prodrome de la Flore algologique des Indes Néerlandaises.

List of Names to which the Annotationes are regularly sent.

AFRICA.

Cape Town.

South African Museum.

ARGENTINE REPUBLIC.

Buenos Ayres.

Sociedad Cientifica Argentina.

AUSTRIA-HUNGARY.

Agram.

National-Museum der Kgl. Franz-Josephs-Universität.

Budapest.

Zoolog. u. vergleich-anatomisches Institut.

Zoolog. Institut d. Kgl. Ungar.-Josephs- Polytechnikum.

Czernowitz.

Zoolog. Institut der Universität.

Graz.

Zoolog.-Zootomisches Institut.

Innsbruck.
Zoolog. Institut.
Klausenburg.
Medic.-naturwiss. Gesellschaft.
Zoolog. Institut d. K. Franz-Josephs-Univ.
Krakau.
K. k. Akademie d. Wissenschaften.
Zoolog. Institut.
Lemberg.
Zoolog. Museum.
Prag.
Zoolog. Institut.
Böhmische Gesellschaft d. Wissenschaften.
Wien.
K. k. Akademie d. Wissenschaften.
K. k. Zoolog.-botan. Gesellschaft.
Zoolog.-vergleich.-anatom. Institut.
Zoolog. Abteilung d. k. k. naturhist. Hofmuseums.

AUSTRALIA.

Melbourne, Victoria.
Univ. of Melbourne.
Sydney, New South Wales.
Univ. of Sydney.
Linnæan Soc. of N. S. W.

BELGIUM.

Bruxelles.
Musée royal d'hist. natur. de Belgique.
Société royale Linnéenne de Bruxelles.
Gand.
Musée zoolog.
Liège.
Institut zoolog.
Louvain.
Cellule, Redaction de la, Chez M. le Prof. Carnoy.
Institut zoolog.

BRAZIL.

Rio de Janeiro.
Museu nacional.
Sao Paulo.
Museu Paulista.

BRITISH INDIA.

Bombay.
Univ. of Bombay.
Calcutta.
Medical College.
Madras.
Univ. of Madras.

CANADA.

Montreal.
McGill College.
Toronto.
Univ. of Toronto.

CHILI.

Santiago.
Deutscher wissensch. Verein.
Société scientifique du Chili.

CHINA.

Shanghai.
Musée de Zikawei, près Shanghai.

DENMARK.

Kjöbenhavn.
Naturhistorisk Forening.
Zoolog. Museum.

DEUTSCHLAND.

Vide GERMANY.

ENGLAND.

Vide GREAT BRITAIN & IRELAND.

FRANCE.

Bordeaux.
Société linnéenne.

Caën.
Soc. linnéenne de Normandie.

Clermont-Ferrand.
Faculté des sciences.

Grenoble.
Soc. de statistique des sciences natur. et des arts industriélles d. départ. de l'Isère.

Lille.
Laboratoire de Zoologie.

Lyons.
Association des amis d. sc. natur.

Marseilles.
Académie des sciences, belles lettres et arts.

Montpéllier.
Académie des sciences et lettres.

Menton.
Allis, Laboratoire de M. E. Ph.

Nancy.
Laboratoire zoolog. de la Faculté d. sciences.

Nantes.
Soc. d. sc. natur. de l'ouest de la France.

Paris.
Institut Pasteur.
Laboratoire d'histologie de la Faculté de Médicine.
Laboratoire de zoologie de la Faculté des sciences.
Muséum d'historie naturelle.
S. Altesse serenissime Prince de Monaco.
Soc. de Biologie.
Soc. zoolog. de France.

Rouen.
Soc. des sc. naturelles.

Toulouse.
Soc. de l'histoire naturelle.

GERMANY.

Berlin.
Anatom. Institut, II.
Kgl. Akademie der Wissenschaften.
Zoolog. Institut.

Bonn.
Anatom. Institut.
Naturhist. Verein d. preus. Rheinlande, Westfalens u. d. Regierungsbezirks Osnabrück.
Zoolog. u. vergl.-anatom. Institut.

Braunschweig.
Naturwissenschaftl. Rundschau, Redaktion der.

Breslau.
Anatom. Institut.
Zoolog. Institut.

Dresden.
Kgl. zoolog. u. anthrop.-ethnogr. Museum.

Erlangen.
Biologisches Centralblatt, Redaktion bei Herrn Prof. Dr. Rosenthal.
Zoolog. Institut.

Frankfurt am Main.
Senckenberg. Institut u. Museum.

Freiburg, i. Br.
Anatom. Institut.
Zoolog. Institut.

Giessen.
Anatom. Institut.
Deutsche zoolog. Gesellschaft bei Herrn Prof Dr. J. W. Spengel.
Zoolog. u. vergl.-anatom. Institut.

Göttingen.
Anatom. Institut.
Zeitschr. f. wiss. Mikroskopie, Redaktion bei Herrn Prof. Dr. W. J. Behrens.
Zoolog.-zootom. Institut.

Greifswald.
Anatom. Institut.
Zoolog. Institut.

Halle a. S.
Anatom. Institut.
Zoolog. Institut.

Hamburg.
Naturhist. Museum.

Hannover.
Naturhist. Gesellschaft.

Heidelberg.
Anatom. Institut.
Zoolog. Institut.
Zoolog. Centralblatt, Redaktion bei Herrn Dr. A. Schuberg.

Helgoland.
Kgl. Biolog. Anstalt.

Jena.
Anatom. Institut.
Anatom. Anzeiger, Redaktion bei Herrn Prof. Dr. Karl v. Bardeleben.
Zoolog. Institut.

Karlsruhe.
Naturwiss. Verein.

Kiel.
Anatom. Institut.
Zoolog. Institut.

Königsberg.
Anatom. Institut.
Zoolog. Institut.

Leipzig.
Anatom. Institut.
Carus, Herr Prof. Dr. J. V.
Kgl. Sächsische Gesellschaft. d. Wissenschaften.
Zoolog. Institut.

Marburg.
Anatom. Institut.
Gesellschaft zur Beförderung d. gesamten Naturwissenschaft.
Zoolog. Institut.

Metz.
Société d'hist. natur. de la Moselle.
Verein für Erdkunde u. Naturwissenschaft.

München.
Anatom. Institut.
Gesellschaft f. Morphologie u. Physiologie.
Zoolog. Sammlung.

Münster i. Westfalen.
Westfälischer Provinzialverein f. Wissenschaft u. Kunst.

Plön.
Biologische Station.

Rostock.
Anatom. Institut.
Zoolog. Institut.

Strassburg.
Anatom. Institut.
Gesellschaft f. Wissenschaft, Landwirtschaft u. Kunst.
Zoolog. Institut.

Tübingen.
Zoolog. Institut.

Wiesbaden.
Nassauischer Verein f. Naturkunde.

Würzburg.
Anatom. Institut.
Physikalisch-medicin. Gesellschaft.
Zoolog. Institut.

Great Britain & Ireland.

Aberdeen.
Natural History Museum.

Bangor.
University College of North Wales.

Belfast.
Queen's College.

Birmingham.
Birmingham Nat. Hist. & Philosoph. Society.

Bristol.
University College.
Cambridge.
Balfour Library.
Cardiff.
University College of South Wales & Monmouthshire.
Cork.
Queen's College.
Dublin.
Univ. College.
Univ. of Dublin.
Dundee.
Univ. College.
Edinburgh.
Royal Society of Edinburgh.
Zoolog. Museum.
Glasgow.
Laboratory of Nat. Hist.
Leeds.
Yorkshire Naturalists' Union.
Liverpool.
Biological Dep't.
Liverpool Biolog. Society.
London.
Howes, Prof. G. B.
Linnæan Society.
Nature, Editor of.
Natural Science, Editor of.
Nat. Hist. Museum, South Kensington.
Royal Asiatic Society.
Royal Microscopical Society.
Royal Society.
Royal College of Science.
University College.
Zoological Society.
Manchester.
Manchester Microscopical Society.
Owens College, Zoolog. Dep't. of.
Nottingham.
Nottingham Naturalists' Society.
Oxford.
Biolog. Dep't. of the University.
Plymouth.
Marine Biolog. Ass. of the United Kingdom, Laboratory of the.
St. Andrews.
University.
Tring.
Zoolog. Museum.

HOLLAND.

Amsterdam.
Kon. Zoologisch Genootschap "Nat. Artis Magistra."
Zoologisch Laboratorium en Museum.
Groningen.
Zoolog. Institut van Rijks-Univ.
Helder.
Zoolog. Station.
Leiden.
Zoolog. en zootom. Laboratorium.
Rotterdam.
Nederlandsche Dierkundige Vereeniging.
Utrecht.
Zoolog. Museum en Laboratorium.

HUNGARY.

Vide AUSTRIA-HUNGARY.

IRELAND.

Vide GREAT BRITAIN & IRELAND.

ITALY.

Bologna.
Gabinetto di zoologia di R. Università.

Cagliari, Sardegna.
Laboratorio e museo di zoologia e d'anatom. comparata di R. Università.
Firenze.
R. Museo di storia natur.
Genova.
Museo zoologico.
Messina.
Gabinetto di zoolog., anat. comp. e Fisiologia.
Modena.
Instituto di zoologia ed anat. comp.
Napoli.
Società dei naturalisti.
Statione zoologica.
Padova.
Instituto di zoolog. ed anat. comp.
Palermo.
R. Università.
Pisa.
Gabinetto zoologico-zootomico.
Roma.
Gabinetto di zoolog. di R. Università.
R. Accademia dei Lincei.
Società per gli studi zoologici.
Torino.
R. museo zoologico.

Japan.

Tokyo.
Asiatic Society of Japan.
Deutsche Gesellschaft f. natur- und Völkerkunde Ostasiens.

Java.

Batavia.
Koninklijke Natuurkundige Vereeniging in Nederlandsch Indië.
Buitenzorg.
Jardin botanique.

Malacca.

Singapore.
Raffles Museum.

Mexico.

Mexico.
Museu nacional.

New Zealand.

Christchurch.
Canterbury College, New Zealand Univ.
Dunedin (Otago).
Univ. of Otago.

Norway.

Bergen.
Museum.
Christiana.
Zootomisk Institut.

Portugal.

Coimbra.
Museo zoologico de Universidade.

Philippine Islands.

Manilla.
Real y Pontificia Universidade de Santo Tomai.

Roumania.

Bukarest.
Institul de Morphologie.

Russia.

Charkow.
Zoolog. Museum d. kais. Univ.
Dorpat (Jurjew).
Zoolog. Museum d. kais. Univ.
Helsingfors.
Zoolog. Mus. d. kais. Alexanders-Univ.

Kasan.
Zoolog. Cabinet u. Mus. d. Kais. Wladimir-Univ.
Moskau.
Société impér. des naturalistes de Moscou.
Odessa.
Kais. neurussische Univ.
Tobolsk.
Museum.
Tomsk.
Zoolog. Institut d. kais. Univ.
Warschau.
Zoolog. Cabinet u. Labor. d. kais. Univ.

SCOTLAND.
Vide GREAT BRITAIN & IRELAND.

SIBERIA.
Vide RUSSIA.

SPAIN.

Madrid.
Facultad de ciencias.

SWEDEN.

Lund.
Zoologiska Museum.
Stockholm.
Naturhist. Riks-Museum.
Zootomiska Institutionen.
Upsala.
Zoologiska Museum.

SWITZERLAND.

Basel.
Zoolog. Institut.
Bern.
Naturforschende Gesellschaft.
Zoolog. Institut.
Genève.
Laboratoire d'anat. comp. et de microscopie.
Musée d'hist. natur.
Neuchâtel.
Société des sciences natur.
Zürich.
Concilium bibliographicum.
Zoolog.-vergl.-anat. Laboratorium.

UNITED STATES OF AMERICA.

Ann Arbor, Mich.
University of Michigan.
Austin, Texas.
Univ. of Texas.
Baltimore, Md.
Johns Hopkins Univ.
Berkeley, Cal.
University of California.
Boston, Mass.
Public Library of the City.
Champaign, Ill.
State Lab. of Nat. Hist.
Chapel Hill, N. C.
Univ. of North Carolina.
Chicago, Ill.
Univ. of Chicago.
WATASE, Dr. S.
WHITMAN, Prof. C. O.
Hanover, N. H.
Dartmouth College.
Ithaca, N. Y.
Cornell University.
Lincoln, Nebr.
Univ. of Nebraska.
New Haven, Conn.
Yale University.
New York City.
Columbia Univ., Biolog. Dep't. of.
N. Y. Academy of Sciences.
Science, Editor of.
Palo Alto, Cal.
Leland Stanford Univ.
Philadelphia, Penn.
Academy of Nat. Sciences.

American Philosophical Society.
American Naturalist, c/o Prof. Frazer.

Princeton, N. J.
Princeton College.

Providence, R. I.
Brown University.

San Francisco, Cal.
California Acad. of Sciences.

Salem, Mass.
Morse, Prof. E. S.

Washington, D. C.
Biological Society of Washington.
Microscopical Publishing Co.
National Acad. of Sciences.
National Museum.
Smithsonian Institution.
Stejneger, Dr. Leonhard.
U. S. Surgeon-General's Office.

Williamstown, Mass.
Williams College.

Worcester, Mass.
Clark University.

West Indies.

Kingston, Jamaica.
Institute of Jamaica.

List of Publications received by the Zoological Society of Tokyo before the issue of the Annotationes.

1. Bolletino della Societa Romana per gli studi Zoologici. Complete vol. III (1894); vol. IV (1895); vol. V. (1896).
From the Society.
2. Bulletin de la Société de France. Complete vol. XX (1895).
From the Society.
3. Revue des Sciences Naturalles à St-Petersbourg. Complete vols. for 1890, 1891, 1892, and 1893.
From the Publisher.
4. Comptes rendus des Sciénces de la Societe Imperiale des Naturalistes de St-Petersbourg. No. 7 and 8 for 1895, No. 1–5 for 1896, No. 1 for 1897.
From the Society.
5. Travaux de la Société des Naturalistes de St-Petersbourg, Section de Zoologie et de Physiologie. Complete vols. for 1894 and 1895.
From the Society.
6. Travaux de la Société des Naturalistes de St-Petersbourg, Section de Botanique. Vols. for 1894 and 1895.
From the Society.
7. Travaux de la Société des naturalistes de St-Petersbourg. Section de Geologie et de Mineralogie. Vols. XXIII and XXIV for 1895 and 1896, and No. 2 of vol. XXI.
From the Society.

8. Actes de la Société Scientifique du Chili.
liv. 5 Tome II; liv. 1et 2 Tome III; liv. 1–5 Tome V; liv. 1, 2, 3, 5, Tome VI.
From the Society.
9. Anales de la Sociedad Ceintifica Argentina;
entrega 1–3 and 6 Tomo XL; entrega 6 Tomo XXXIX; entrega 1, 2, 4–6 Tomo XLI; entrega 1–3, 5, 6 Tomo XLII; entrega 1–5 Tomo XLIII.
From the Society.
10. The Microscope.
No. 3 vol II; No. 1–5, 7, 9, 10–12, vol. III; No. 1–12, vol. IV; 1–9, vol. V.
From the Microspical Publishing Company.
11. Proceedings of the Academy of Natural Sciences of Philadelphia.
Part II and III for 1895; part I for 1896.
From the Academy.
12. Verhandlungen der Deutschen Zoologischen Gesellschaft.
Jahrgang 5 and 6 for 1895 and 1896.
From the Society.
13. Congreso Cientifico General Chileno. De 1894.
14. Videnskabelige Meddelelser fra den naturhistoriske Forening Kjobenhavn for Aarat 1895.
15. Revista do Museu Paulista, 1895.
26. Bolletino dei Musei di Zoologia ed anatomia comparata della R. Universita di Genova. No. 54, 55 of 1896.
17. Etude sur le développement embryonaire du Gammaras pulex, reprint.
From the authoress, Mde. Marie Ressyskaia-Kojernikova.
18. Beiträge zur feineren Structur des Integmentes der Hatteria punctata.
From the author, G. Osawa.
19. The Indian Magazine and Review.
New Series, No. 74, vol XXVIII.
From the Publisher.

PRINTED AT THE "TOKYO PRINTING CO., LD." TOKYO, JAPAN.

日本動物學彙報

第二卷

明治三十一年發兌

ANNOTATIONES ZOOLOGICÆ JAPONENSES

AUSPICIIS

SOCIETATIS ZOOLOGICÆ TOKYONENSIS

SERIATIM EDITÆ.

Volumen II.

Cum IV tabulis et XXXVII figuris in texto.

TOKYO.

1898.

Pars I.

Published February 25, 1898.

Pars II.

Published June 22, 1898.

Pars III.

Published October 10, 1898.

Pars IV.

Published December 31, 1898.

A Summary of Japanese Cicadidæ with Description of a New Species.

By **M. Matsumura.**

Entomological Laboratory, Agricultural College, Sapporo.

With Pl. I.

Japan is very rich in insect life. Cicadidæ, as well as many others of the hexapod tribe, are found here, and the following sixteen species are well known in this Empire. The species peculiar to Japan are marked with a star.

1. *Platypleura repanda*, Fabr.
2. **Grapsaltria colorata*, Stål.
3. **Cosmopsaltria opalifera*, Walk.
4. *Pomponia maculaticollis*, Motsch.
5. **Pomponia japonensis*, Dist.
6. *Leptosaltria tuberosa*, Sign.
7. **Terpnosia Pryeri*, Dist.
8. **Terpnosia nigrocosta*, Motsch.
9. *Cryptotympana fascialis*, Walk.
10. *Cryptotympana pustulata*, Fabr.
11. **Cicada flammata*, Dist.
12. **Cicada bihammata*, Motsch.
13. *Cicada clara*, Motsch.
14. *Cicada vacua*, Oliv.
15. **Melampsaltria radiator*, Uhler.
16. **Melampsaltria yezoensis*, sp. nov.

Of about 330 species of the described Cicadidæ in the world, fifteen are known to occur in Japan; but owing to insufficient descriptions I am very doubtful whether nos. 13 and 14 are not merely synonymic names or altogether different species. Of the sixteen species mentioned above nos. 6, 7, 8, 10, and 15 are confined to the Main Island; and the genus *Graptosaltria* is peculiar to Japan.

1. *Platypleura Kœmpferi* (fig. 1, a, b).

Tettigonia Kæmpferi, Fabricius. Ent. syst. 1794.
Cicada Kæmferi, Walk. List Hom. 1850.
Platypleura Kæmpferi, Butl. Cist. Ent. 1874.
Platypleura hyalino-limbata, Sign. Bull. Soc. Ent. Fr. 1881.
Platypleura fuscangulis, Butl. Cist. Ent. 1874.

This is a very common insect in Japan and is known as *ni-ni zemi*. Its description given by Mr. L. DISTANT in his Monograph of Oriental Cicadidæ is as follows:—

"Head, pronotum, and mesonotum dull ochraceous; head with the following black markings:—a narrow transverse fascia on front, a transverse fascia between eyes, forming a spot at area of ocelli, continued on inner margin of eyes, two small discal spots, and a fasciate spot anteriorly and posteriorly, the oblique furrows and the lateral dilated margins black; mesonotum with 4 obconical spots on anterior margin (the central ones shortest), a lanceolate discal spot much widened posteriorly and a spot in front of each anterior angle of the basal cruciform elevation, black. Abdomen black, the tympanal coverings and posterior segmental margins dull ochraceous, head beneath, sternum, and legs dull ochraceous; central sulcation and posterior margins to face; a fascia between eyes and face, some obscure sternal spots, and a spot at base of operculum, black; abdomen beneath blackish, with the posterior segmental margins ochraceous. Tegmina with about the basal half opaque and creamy ochraceous, costal membrane with two fuscous spots, and the following fuscous fasciæ:—one basal, one oblique, passing through centre of radial area and terminating at

apex of lower ulnar area, and a broad, waved, and irregular fascia commencing at apex of radial area and united with the preceeding fascia at apex of lower ulnar area; between the second and third fasciæ are some small fuscous spots and a semihyaline spot near end of radial area, and a similar spot in lower apical area, remainder of tegmina hyaline, with a broad subapical fuscous fascia extending to apex of third ulnar area, an apical fuscous spot and some irregular small fuscous spots on the apices of longitudinal veins to apical areas. Wings dark fuscous, overlapping at centre, outwardly convex, but somewhat oblique at their lateral margins; the face is considerably compressed with the central sulcation broad and somewhat deep."

Long. excl. tegm. 21–22 mm. Exp. tegm. 65–73 mm.

Hab.—China and Japan.

This beautiful insect is found all over Japan from the Kurile Islands in the north to Ryuku in the south, and from the variegated coloration of its wing is very familar. It comes out early in June and its monotonous *ni-ni* sound is heard until the end of September. Its voice is heard from morn till night, and it always remains in the same place unless disturbed by an enemy. Its pupal covering is easily distinguished from that of other species particularly by some earth always adhering to it. According to L. DISTANT this species is entirely confined to Japan and China. I sent a specimen of this insect some years ago to Mr. L. O. HOWARD, entomologist to the Agricultural Department of the United States and by his kindness it was handed on to Prof. UHLER, president of the Maryland Academy of Sciences. It was by him identified as *Platypleura repanda,* Linn. of Europe and Asia (fig, 2, a, b). Ninteen specimens of this insect sent to the Columbian Exposition by Mr. NAWA, under the name of Prof. MITSUKURI, have also been identified as *P. repanda,* L. It is doubtful whether it is after all the real *repanda,* because the Japanese insect is not only smaller in size but also, according to the description and figures given by Mr. DISTANT in his classic work, it differs much in its marking. However I have placed this species on the plate for reference.

2. *Graptosaltria colorata* (fig. 3, a, b).

Graptosaltria colorata, Stål. Berlin. Ent. Zeit. 1865.

This species is peculiar to Japan, and the only known representative of the genus. It is very common on the Main Island and in Ryukyu, but much less so in Hokkaido. It is commonly known as *aburazemi*. Its description is as follows :—

"Head black ; apex and base of front, anterior lateral margins, a small spot behind eyes, and two large discal spots to vertex castaneous ; ocelli and eyes ochraceous. Pronotum castaneous, the anterior and posterior margins, and two narrow central longitudinal fasciæ, blackish ; extreme lateral margins castaneous. Mesonotum black, with 2 faint obconical spots at centre of anterior margin ; in some specimens there are a few castaneous spots ; cruciform elevation castaneous, with its centre and apical angles black. Abdomen above black. Body beneath ochraceous, mottled with dark castaneous and blackish ; opercula dull ochraceous, the outer margin and a subapical fascia castaneous, a small pale spot near apex of lower apical area."

Long. excl. tegm. 30–37 mm. Exp. tegm. 92–118 mm.

The females of this species are invariably larger than the males, just contrary to what is known in the other species ; and on examination each contains, according to Mr. NAWA, on the average 349 long, slightly curved eggs. It cries from morn till night, but chiefly towards evening at sunset. It continually changes its place ; sometimes resting upon the telegraph-pole ; sometimes on the fence and at others on bamboos, etc. This, like the preceeding species, is very common and is easily distinguished by its reddish brown wings.

3. *Cosmopsaltria opalifera* (fig. 4, a, b).

Dundubia opalifera, Walker. List Hom. 1850.
Cosmopsaltria opalifera, Dist. Monog. Orient. Cicad. 1890.

This small species is also peculiar to Japan, and is commonly known

as *tsukutsukubōshi.* Its ground color is black, while the yellowish green markings differ very much according to individuals. Its description is as follows :—

"Head and thorax above ochraceous; head with its lateral striations and a spot near base of front, the area of the ocelli, and a large irregular lateral fascia in front of eyes, black; pronotum with two central black fasciæ somewhat hour-glass shaped, the furrows, a spot near each lateral angle of posterior margin, and the extreme lateral margin, black; mesonotum with five large black fasciate spots, of which two are obconical with their bases on the anterior margin, one large central and subtriangular, and one somewhat broken occupying each lateral area; abdomen above blackish, the tympanal coverings ochraceous. Head beneath sternum, legs, and opercula ochraceous; apices of anterior femora, the apices of the tibiæ and tarsi, the transverse striations and longitudinal sulcation to face, and the margins of the opercula black; abdomen beneath castaneous, apex pitchy.

"Tegmina and wings pale hyaline, the venation brownish; tegmina with the costal membrane brownish-ochraceous, the transverse veins at the bases of the second and third apical areas fuscated. The opercula are short, narrowed and angulated at apices, and reach the third abdominal segment.

"Long. excl. tegm. ♂ 30 mm. Exp. tegm. 82 mm."

It comes out in late summer or early autumn, and for this reason the Chinese call it "winter cicada," it being the forerunner of winter. It is very hard to catch on account of its agility, but at the time of oviposition it seems to become very sluggish. Its screamings are heard at first far up on high trees or in mountain regions, but gradually it comes down, and abounds near human habitations and so becomes familiar to all.

In Hokkaido specimens are much smaller and the species is here more local, it specially prefering regions where willows abound, the latter being probably its food plant.

4. *Pomponia maculaticollis* (fig. 5, a, b).

Cicada maculaticollis, Motschulsky. Bull. Soc. Nat. Mosc. 1866.

Pomponia Maculaticollis, Dist. Monog. Orient. Cicad. 1891.

This is an alpine insect, but in Tokyo it is often found near houses and is as familiar as the former species. It is commonly known as *mimmin zemi*, deriving its name from the tone of its cry. It is generally distributed throughout Japan, and is also common in China, where it presents a slight variation in color. Description as follows:—

"Head, pronotum, and mesonotum greenish-ochraceous. Head with the transverse striæ to front, the area of the ocelli, a larger spot at inner margins of eyes, posterior margins of eyes, and a transverse linear spot at anterior angles of vertex, black. Pronotum with two central linear fasciæ, sinuated and ampliated anteriorly and posteriorly, a discal spot on each side, the furrows, two transverse spots on outer margin, and the extreme lateral and posterior margins, black. Mesonotum with two central obconical spots, followed by some irregular markings on each side of disk, a small rounded spot at anterior angles of basal cruciform elevation and two central lines on disk of same, black. Body beneath and legs greenish ochraceous; transverse striæ to face, inner area of eyes, central line to and apex of rostrum, femoral streaks, bases and apices of tibiæ, outer and posterior margins of opercula, and basal halves of abdominal segments, black.

"The opercula are broad, convex and overlapping; the face has a faint central longitudinal sulcation, and the rostrum extends to the posterior coxæ.

"Long. excl. tegm. 40–43 mm. Exp. tegm. 120–123 mm."

Hab.—Japan and China.

It is very common in August, coming out quite late among cicadas, and like the preceding species is somewhat difficult to catch.

5. *Pomponia japonensis* (fig. 6, a, b).

Pomponia japonensis, Distant. Monog. Orient. Cicad. 1892.

This species very much resembles *Pomponia fusca*, Olivier of

continental India, only differing in the opercula being widely divided and not meeting at the inner side, and also by the rostrum only reaching the posterior coxæ, while in the species of Olivier it extends to the basal segment of the abdomen. Its description is as follows :—

" Head, pronotum, and mesonotum greenish-ochraceous. Head with the anterior margins of front, an irregular central fascia to vertex enclosing the ocelli, a large spot on inner side of eyes, and the anterior lateral angle of vertex, dark olivaceous. Pronotum with a broad central longitudinal fascia, two large oblique spots on each lateral area, and a spot on the lateral margin, brownish olivaceous, mesonotum with seven brownish-olivaceous spots ; two sinuate central ones, and a long spot on each lateral area, two small spots of the same color in front of each anterior angle of the basal cruciform elevation. Abdomen pale castaneous with ochraceous pilosity. Head beneath, sternum, legs and opercula pale greenish ; upper and apical areas of face, a spot near apices of femora, apices of anterior and intermediate tarsi, apex of rostrum and a triangular spot between the intermediate and posterior coxæ, dark fuscous. Abdomen beneath dark ochraceous.

" Tegmina and wings pale hyaline; tegmina with the costal membrane greenish, transverse veins at the bases of the second, third, fourth, fifth, seventh and eighth apical areas infuscated, and a marginal series of small fuscous spots situated at the apices of the longitudinal veins to apical areas ; the venation is otherwise ochraceous, sometimes replaced by black ; basal cell and claval margin brownish-ochraceous. Wing with the venation brownish-ochraceous ; claval margin darker in hue.

" Long. excl. tegm. ♂ 36 mm. Exp. tegm. 88–92 mm."

This beautiful species is also peculiar to Japan and is known commonly as *higurashi* or *kanakana zemi* ; the latter name being derived from its screamings. It is an alpine insect, many living in deep forests where sunlight does not penetrate. Its voice is heard especially at sunrise and sunset. In Hokkaido it is very common near dwellings and is the earliest cicada we meet with. It cries from morn till night with its peculiarly accented tone.

6. *Leptosaltria tuberosa* (fig. 7, a, b).

Cicada tuberosa, Signoret. Ann. Soc. Ent. Fr. 1847.
Dundubia tuberosa, Walk. List Hom. 1850.
Leptosaltria tuberosa, Stål. Berl. Ent. Zeit. 1866.

This is a somewhat rare insect resembling the *haruzemi* in its general features, but differs from it in the smallness of its head, the lateral margins of the pronotum being distinctly toothed, and the second and third ventral segments in the male being furnished with distinct, lateral tubercules. Description as follows :—

"Body above brownish ochraceous ; head with some lateral curved fasciæ to front, some oblique fasciæ to vertex, area of ocelli and basal margin blackish; pronotum with two central blackish longitudinal lines, the anterior margin, the edge of lateral margin, and a spot near each lateral area blackish, posterior margin greenish or ochraceous ; mesonotum with the following blackish markings :—a narrow central longitudinal fascia, on each side of which is a short curved fascia; these are followed by a short triangular spot in front of the basal cruciform elevation, and a fascia on each lateral margin uniting with the preceding fascia at base. Abdomen with the segmental margins blackish.

"Tegmina and wings pale hyaline, the venation brownish; tegmina with the costal membrane brownish, a blackish spot at base of upper ulnar area, the transverse veins at the bases of second, third, fifth and seventh apical areas infuscated, and a submarginal series of small fuscous spots placed near the apices of the longitudinal veins to apical areas.

"Opercula small, situated wide apart, their apices broadly convex.

"Long. excl. tegm. ♂ 27–32 mm. Exp. tegm. 72–79 mm."

This is quite a widely distributed species known also in continental India, Java, and other places. I have never seen it in this Empire and only know of its existence here from figure and description. I am not able therefore to describe its character.

7. *Terpnosia Pryeri* (fig. 8, a, b).

Terpnosia Pryeri, Distant. Monog. Orient. Cicad. 1892.

"♂. Head black, thickly greyishly pilose with two ochraceous spots on posterior margin. Pronotum ochraceous, thickly pilose with two central longitudinal fasciæ, a curved linear spot on each side of disk, the fissures and the inner lateral and posterior margins black; a fuscous spot on lateral margins at posterior angles, and a small central black spot on posterior margin. Mesonotum dark ochraceous, with four obconical black spots,—the central pair shortest—a central lanceolate black spot extending from the cruciform elevation to near anterior margin, and a very small spot on anterior margin between the outer obconical spots. Abdomen pale castaneous, the posterior segmental margins—widest at centre—black. Body beneath ochraceous, thickly pilose; striations to face and sometimes fascial disk, apices and sometimes under surface of femora, bases of tibiæ, apices of tarsi, sternal spot and extreme base of abdomen, black.

"Tegmina and wings pale hyaline, the venation ochraceous or fuscous; tegmina with the costal membrane ochraceous; the transverse veins at the bases of the second, third, fifth and seventh apical areas infuscated.

"The rostrum reaches the posterior coxæ; the face is obscurely sulcate and striate.

"Long. excl. tegm. ♂ 27 mm.; ♀ 22 mm. Exp. tegm. ♂ 67 mm.; ♀ 64 mm."

This is also a species peculiar to Japan and appears to be quite local in its occurrence, not being found in the southern provinces. It is commonly known as *haruzemi* or *matsumushi*; the former name on account of its early appearance, and the latter on account of its always living on pine trees. Its coloration much resembles pine bark, and its cry is often heard near dwellings, but it is very difficult to see. It comes out in spring and its nearly monotonous sound of *jiwa-jiwa* may be heard from a good distance off.

8. *Terpnosia nigrocosta* (fig. 9, a, b).

Cicada nigrocosta, Motschulsky. Bull. Soc. Nat. Mosc. 1866.

Terpnosia nigrocosta, Distant. Monog. Orient. Cicad. 1892.

"♂. Head ochraceous, marginal striations to front and the whole of vertex—excluding two small spots near eyes and two basal spots—black. Pronotum blackish; the lateral and posterior margins, a central longitudinal fascia, and some discal macular markings, ochraceous; extreme edges of posterior and lateral margins, with three marginal spots near each lateral angle and a central basal marginal spot black. Mesonotum ochraceous with a large central fused spot, an irregular fascia on each lateral area, and a large spot in front of the basal cruciform elevation, black. Abdomen pale castaneous, with greyish tomentose lateral markings, the base,—narrowly—the apical segment and areal appendage, and a lateral series of segmental spots, blackish. Body beneath ochraceous; a central fascia and transverse striations to face, sternal spots, opercula, femora, anterior tibiæ, base of posterior tibiæ, base and apex of anterior and intermediate tarsi, and margins of the apical segment, black or blackish.

"Tegmina and wings pale hyaline, the venation mostly fuscous; tegmina with the costal membrane ochraceous, its outer edge black; the transverse veins at the bases of the second, third, fifth, seventh and eighth apical areas infuscated, a series of small marginal spots on the longitudinal veins to apical areas, a spot on venation at base of upper ulnar area and the same at apex and anterior margin of basal cell, and a claval streak, black.

"The rostrum reaches the posterior coxæ; the face is very obscurely sulcated and somewhat strongly transversely striate.

"Long. excl. tegm. ♂ 30–31 mm.; ♀ 23–26 mm. Exp. tegm. ♂ 77–80 mm.; ♀ 72–88 mm."

This very much resembles the preceding species, differing only by its larger size, its color and the shape (best explained by figure) of its opercula, the fasciated abdomen and the relative length of the first and second apical areas to tympana, the first in *T. Pryeri* being about twice as long as the second. It is also peculiar to Japan. It is recorded that Mr. LEWIS, the celebrated coleopterist, first procured a good series of the specimens of this species during his entomological journey in Japan. It has

been taken at Chuzenji, Nikko, and therefore seems to be quite an alpine insect. I think *nikkōharuzemi* is the proper name for it.

9. *Cryptotympana fascialis* (fig. 10, a, b).

Cicada fascialis, Walker. List Homop., Suppl. 1858.
Cryptotympana fascialis, Stål. Öfv. Vet.-Ak. Förn. 1862.
Fidicina nigrofuscata, Motsch. Bull. Soc. Nat. Mosc. 1866.

"♂. Body above black, sparingly and finely pilose; tympana castaneous, basal abdominal segment narrowly margined with greyish-white pile, especially at the lateral margins; eyes dull obscure ochraceous. Body beneath thickly clothed with greyish-white pile; head, prosternum, lateral margins and a broad central fascia to abdomen, dull olivaceous; anterior and intermediate legs dull olivaceous streaked with ochraceous, posterior legs ochraceous, femoral streaks and apices of tibiæ olivaceous, opercula bright ochraceous; face with a central longitudical fascia and the margins of head between face and eyes dull ochraceous.

"Tegmina and wings hyaline, the venation olivaceous and fuscous; tegmina with the costal membrane olivaceous, the costal area blackish; transverse veins at the bases of the second and third apical areas slightly infuscated; base of tegmina not extending beyond basal cell (excluding venation) blackish; vein beneath, lower ulnar area reddish ochraceous; wings with less than basal half blackish.

"The opercula are about half the length of the body, subovate, overlapping at their central basal margin, and their apices broadly and convex rounded.

"Long. excl. tegm. ♂ 45–49 mm. Exp. tegm. 120–125 mm."

This is the largest cicada existing in this Empire, and though common in Okinawa, is not found in the north. I have no information about its character, but should like to hear about it from any one who has travelled in that region. I am only acquainted with its figure and description as given by DISTANT, and it is said that PRYER has collected it in Ryuku. This species is also found in Siam and China.

10. *Cryptotympana pustulata* (fig. 11, a, b).

Tettigonia pustulata, Fabr. Mant. Ins. 1787.
Tettigonia atrata, Fabr. Mant. Ins. 1787.
Cicada atrata, Oliv. Enc. Meth. 1790.
Cicada nigra, Oliv. Enc. Meth. 1790.
Cicada pustulata, Oliv. Enc. Meth. 1790.
Cicada atrata, Sign. Rev. and Mag. Zool. 1849.
Fidicina atrata, Walk. List. Hom. 1850.
Fidicina bubo, Walk. List. Hom. 1850.
Cryptotympana bubo, Stål. Öfv. Vet.-Ak. Förn. 1872.
Cryptotympana atrata, Stål. Ann. Soc. Ent. Fr. 1861.
Cryptotympana nigra, Stål. Hemp. Fabr. 1869.

"♂. Body above black; eyes ochraceous; mesonotum with obscure central linear pale castaneous obconical spots, the cruciform elevation also castaneous. Body beneath black; head with the central sulcation, apex and lateral margins of face, the outer and posterior margins of opercula, margins of abdominal segments, and some scattered sternal spots, ochraceous. Legs ochraceous, femoral streaks and bases and apices of tibiæ black.

"Tegmina and wings pale hyaline, the venation ochraceous and fuscous, tegmina with the costal membrane ochraceous, its extreme basal costal edge black, the post-costal area black; less than basal third of tegmina (excluding venation) black; basal cell black, with an ochraceous spot. Wings with less than basal half black. Body robust, but moderately elongate; opercula not half the length of the body, their outer margins oblique and slightly convex, their inner margins strongly oblique to apices, which are broadly and obtusely angulated.

"Long. excl. tegm. ♂ 44 mm. Exp. tegm. 125 mm."

This large insect seems to be quite a tropical form, being found also in the Malay Archipelago, Philippine Islands, Hongkong, and China; in south Japan it is very common, but is not found in Hokkaido and the northern parts of the Main Island. It cries only in the morning, but not in the afternoon, making clamorous and deafening noise somewhat resembling the sound of *sha–sha*. Like the preceding species, it is easily distinguished from any other by its opercula being bright yellow. Mr. Nawa found that it deposits its eggs in the half dead branches of

mulberry-trees, and though I have not yet found their eggs, it seems to me that willow is the food plant in the south. It is commonly known as *kumazemi*.

11. *Cicada flammata* (fig. 12, a, b).

Cicada flammata, Distant. Monog. Orient. Cicad. 1882.

" ♀. Head, mesonotum and abdomen black, the pronotum reddish-ochraceous. Head with a spot at base and apex of front, a spot at anterior angles of vertex and a spot behind eyes reddish-ochraceous; eyes ochraceous. Pronotum with two slender central black fasciæ, narrowed, angulated and joined posteriorly; inner edge of lateral and posterior margins, outer edge of posterior margin and edge at lateral angles, black. Mesonotum with two central obconical spots, the margins of which are reddish ochraceous; the cruciform elevation (excepting centre and angular apices) also reddish-ochraceous. Abdomen with faint traces of a double longitudinal series of white pilose spots. Body beneath dark castaneous, the sternum thickly clothed with greyish-white pile; space between eyes and face black, enclosing an ochraceous spot on anterior margin; legs ochraceous.

" Tegmina and wings hyaline, the venation ochraceous and fuscous. Tegmina with the base—not extending beyond basal cell—ochraceous, a black linear streak extending about inner edge of costal membrane which is ochraceous; transverse veins at the bases of the second and third apical areas, and sometimes the interior of the upper apical area, infuscated; wings with the base narrowly ochraceous, and with an inner and an outer claval ochraceous streak.

" Long. excl. tegm. ♀ 40 mm. Exp. tegm. 120 mm."

This is a common insect in Hokkaido and is often found near houses. It comes out late in summer, especially in the month of August and September, a little earlier than *tsukutsuku bōshi* (*Cosmopsaltria opalifera*). Its cry is heard from morning till night, especially during the hottest part of the day, producing a noisy peculiar *ghi ghi* sound, causing the listener

at a distance to feel somewhat sleepy. It chiefly prefers oak trees. I have not yet found this insect in other parts of Japan; it is probably peculiar to Hokkaido. For this reason it is known as *Yezozemi*.

12. *Cicada bihammata* (fig. 13 a, b).

Cicada bihamata, Motsch. Etud. Ent. 1861.

"♂. Head black; a spot at base of front, the anterior marginal angles of vertex, and a spot a little before posterior margin of eyes, ochraceous; ocelli and eyes dull ochraceous. Pronotum castaneous, its margin ochraceous; a central black fascia containing a lanceolate ochraceous spot and with a wide basal spot of the some color; lateral margins inwardly and posterior margin inwardly and outwardly black, the posterior marginal angle and an oblique spot just before it also black. Mesonotum black, with two discal angulated ochraceous fasciæ united at anterior margin; the lateral margins and the lateral sides and angles of the basal cruciform elevation ochraceous. Abdomen above blackish castaneous; apical segments centrally marked with ochraceous. Body beneath blackish, a spot on anterior margin of face, a marginal spot between face and eyes, lateral margins of the prosternum, legs, opercula and segmental margins ochraceous; legs with blackish markings.

"Tegmina and wings pale hyaline. Tegmina with the venation ochraceous and fuscous; basal cell almost—sometimes partly—black; transverse veins at the bases of the second, third, fourth, fifth and seventh apical areas infuscated; base of claval area ochraceous.

"The opercula about half, or a little more than half, the length of the abdomen, are divergent, with their apices broad, and convexly rounded, their outer margins concavely sinuate and black at outer basal margin.

"Long. excl. tegm. ♂ 33 mm. Exp. tegm. 88 mm."

This very much resembles the preceding species, but differs from it in its small size, its being a little paler, and the date of appearance

being much earlier in summer. Its cry also resembles that of the preceding species though it is not so loud. It frequents trees near houses and is very common in Hokkaido. According to PRYER and LEWIS this species is also found in Tokyo, but I have never come across it. I sent this insect to America for identification a few years ago, and it has been identified as *Cicada Leechi*, Distant, and is said to be found also in China. But according to the description and figures given by DISTANT it differs very much from that species, especially in the form of the opercula and the abdomen not being ornamented with longitudinal series of whitish pilose spots.

13. *Cicada clara.*

Cicada clara, Motsch., Bull. Soc. Nat. Mosc. 1886.

I have not yet seen this insect, and owing to lack of good description, it is not known whether it is merely a synonym or quite a new form. The following description is given by Motschulsky.

"Statura et color cicada orni sed thrace dorso magis nigro. Elongata attenuata opaca, fusco-testaceo, capite thoraceque nigris, subtestaceo pictis, hoc latéribus viridi maculatis, pectore atro, pedibus nigris testaceo annulatis; ♂, abdominis segmento, penultimo subtus trapezoidale, ultimo attenuato, tympanis transversis femoribus anticis bidentatis.

"♂, Long. corp. 12¼ l.; lat. Exp. alar. 31 l.

Hab. Japan."

14. *Cicada vacua.*

Cicada vacua, Olivier, Enc. Meth. 1790.

This also has not yet been identified. The following description is given by Olivier :—

"La cigale vuide.

"La tête, le corps et les pattes sont noir minime ou de couleur fauve ; l'abdomen est vuide et comme transparent, son dernier anneau

est garni de duvet blanc; les etuis et les ailes sont transparens comme du verre.

Hab.—" Elle vient du Japon".

15. *Melampsaltria radiator* (fig. 14, a, b).

Melampsalta radiator, Uhler. Proc. U. S. Nat. Mus. 1896.

Mr. P. UHLER's description of this species is as follows:—

"Form of *Cicada montata,* Hagen, but a little broader, more generally covered with silvery whitish scales, which easily rub off and with the apical valvular ventral segment of the male short, ovate, not tapering at tip, and with the opercula longer, forming curved lobes which approach but do not touch on the middle line of venter. General surface black, polished, with the venter pale fulvous. Vertex a little broader than long, with the apex and base each with a yellowish spot, the latter being placed in an oval cavity, the supra-antennal lobes narrow, testaceous, front moderately blunt, broadly margined with yellow, sulcate on the middle line above, and over this is a large yellow spot, the transverse carinate lines and grooves distinct, rostrum black, reaching to the middle coxæ. Legs greenish, with the base and apex of femora and some lines along their surface, knee tips, and sometimes the middle of tibiæ, base and tip of tarsi, besides the nails, and the three spines of anterior femora, black, the inner spine much longer than the others. Pronotum bordered behind and on the sides with greenish yellow, mesonotum with a deltoid yellow spot each side of disk, connecting with a slender line which continues back to the borders of the cross, and from thence on the posterior and lateral carinate borders. Wing covers with large and often irregular meshes, the apical series beginning with a moderately short trangular one, and followed by longer curved ones to the inner bend of the margin, the costal vein greenish yellow, veins dark brown, yellow basally, and including the membrane, wings with brown veins, the inner area striped and margined with smoke brown, the basal membrane reddish, a streak (margined with fuliginous)

running out from it, pale plumbeous. The inner alulet is large, ovate, bounded by a course vein and traversed by numerous long veins. Abdomen long and narrow with the middle of venter striped with a series of black spots.

" Length to tip of abdomen: ♂ 20 mm.; ♀ 22 mm. Spread of wing-covers, 55–57 mm.

" The female has a much longer and more slender spur at apex of the tergum than in the male. In this species the two ulnar veins are separated at their origin on the angle of the basal areole, and the inner alulet (*Schlussfeld*) of the wing is broadly rounded and traversed by eight or more very slender veins, forming long areoles."

This is the smallest cicada found in Japan, and it is not only rare but also very hard to collect, being found always on the stems of pine trees which naturally protects it. Its cry very much resembles that of a certain locust (*Xiphidium*), producing a monotonous *chitch-chitchi* sound, by which its presence is betrayed. It comes out in July and its voice is heard to the end of October. It is truly an alpine insect being always found in the mountain forests of the north.

16. *Melampsaltria yezoensis*, sp. nov.

Closely allied to *M. radiator*. Head and thorax above black, sparingly covered with short yellowish metallic pilosity, sternum with silvery short hairs. Basal joint of rostrum yellow; eyes dusky with pale portion; legs testaceous with the following black markings :—fascia of coxa, one or two spots of trochanter, two longitudinal fasciæ and tip of femora, tip and longitudinal fascia of tibiæ, inner side of tarsi and tip of claws, and the three spines of anterior femora. Sternum pale yellow with some black markings, opercula pale yellow with the base black, anterior and posterior margin of pronotum brownish yellow, the sides pale yellow, a deltoid spot on each side of disk and sides of mesonotum yellow, the former not continued with a slender line which extends back to the borders of the cruciform elevation. Abdomen black with

smooth metallic yellow pilosity, posterior margin of each segment deep yellow. Apical areas of wing covers (tegmina) beginning with a sub-lanceolate one, two veins of second apical area being separated at their origin on the angle of first ulnar area, two veins of fourth ulnar area not separated at their origin, arising from common stalk on the basal cell. Costal, basal and ulnar veins olivaceous, anal vein and apical margin dusky, basal membrane beautiful cinnabar red. Wings, in certain angles of reflection, beautiful purplish blue. The rest same as the former species.

Long. excl. tegm. 26–27 mm. Exp. tegm. 67–69 mm.

Var.? A broad greenish yellow central fascia passes across the pronotum, widened anteriorly to clavate form, posteriorly to equilateral triangular form, bordered by a broad transverse greenish yellow fascia at the posterior margin. Greenish yellow deltoid spot on each side of mesonotum large, just like an inverted M, not continued to the cruciform elevation; the latter being dull yellow and traversed by a central brownish fascia. The common stalk of fourth ulnar vein on the angle of basal cell not so long as in true *yezoensis*. General surface of the body brownish black, sternum, venter, legs much paler than the typical form. Probably this may be quite a different species, but as I have caught only a single specimen, I could not determine fully.

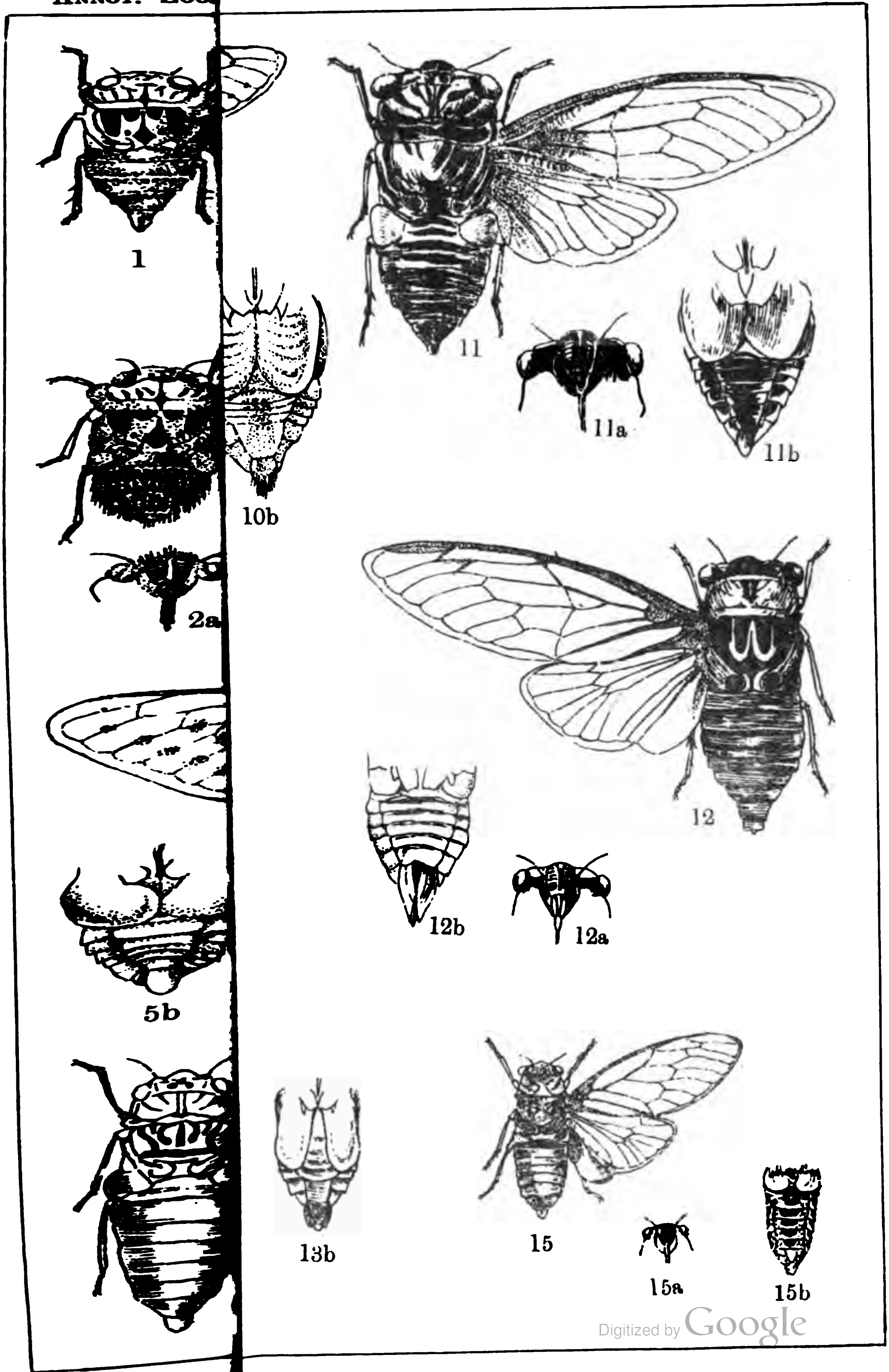
This is closely allied to the preceding species, but is much larger in size and differs in its coloration and venation, and can easily be distinguished from it. I found this insect for the first time last summer in Ishiyama in a forest of birch, its presence being betrayed by its voice, which also resembles that of *M. radiator*. This is not so very rare a species, but being of quite a local occurrence has passed unnoticed through the ten years of my entomological collection in this part of this island. I also heard its voice last year in the deep forest of Jozankei, Abuta, Yamanaka, and Toya during a ramble in the latter part of August.

Besides the species above enumerated it seems to me that there are two or more species which are to be found in some parts of Hokkaido, not yet known to entomologists; for I have heard some unfamiliar sounds of cicada somewhere in a deep forest of Jozankei as well as in other parts. Upon opening the stomach of a trout which I caught last year in Chitose River I found a specimen of a very peculiar species of cicada without head and wing; it is perhaps a new species, but can not well be identified.

EXPLANATION OF PLATE I.

1. *Platypleura Kœmpferi*, Fabr
2. *Platypleura repanda*. L.
3. *Graptosaltria colorata*, Stål.
4. *Cosmopsaltria opalifera*, Walk.
5. *Pomponia maculaticollis*, Mots.
6. *Pomponia japonensis*, Dist.
7. *Leptosaltria tuberosa*, Sign.
8. *Terpnosia Pryeri*, Dist.
9. *Terpnosia nigrocosta*, Mots.
10. *Cryptotympana fascialis*, Walk.
11. *Cryptotympana pustulata*, Fabr.
12. *Cicada flammata*, Dist.
13. *Cicada bihammata*, Mots.
14. *Melampsaltria radiator*, Uhl.
15. *Melampsaltria yezoensis*, sp. nov.

Printed January 24, 1898.


1
10b
2a
5b
13b
11
11a
11b
12
12b
12a
15
15a
15b

On a New Species of Littoral Oligochæta (Pontodrilus matsushimensis).

By AKIRA IIZUKA,

Zoological Institute, Science Coll., Imp. Univ., Tokyo.

With Plate II.

During a short excursion to Matsushima Bay, Province of Rikuzen, last August I collected, among other annelids, an oligochæte referable to the genus *Pontodrilus*, of which only five species* have been recorded from other parts of the world, but as yet none from our coasts. As the species in question presents some remarkable points of difference from any of the known members of the genus, I think it worth while to publish its description.

It is found burrowing in sand, under the half decayed leaves of *Zostera marina*, along the shores of Matsushima Bay, from low tide mark to a certain distance farther up, beyond, as it seems to me, high tide mark. There is no indication of its presence on the surface of the sand, so that it can only be obtained by indiscriminate digging. I myself have obtained only a few specimens, but Mr. B. Onodera of Shiwogama, a small town on the western side of the bay, has been able to send me a large number of them living in kind compliance with my request.

Most of the specimens before me are sexually mature.

* (1) *Pontodrilus littoralis*, Grube from the shores of the Mediterranean. (2) *P. bermudensis*, Beddard from Brazil, Bermuda, and Jamaica. (3) *P. hesperidum*, Beddard from Jamaica. (4) *P. insularis*, Rosa from the Aru Islands. (5) *P. phosphoreus* Dugès from North France.

A. Characters of the adult animal.

In the living state, the annelid in question is of a white color with a light pinkish tint; a single dorsal blood vessel is seen through the more or less transparent wall of the body, as a bright red line running antero-posteriorly and giving off lateral branches.

The body (fig. 1) is long and slender, measuring 90–110 mm. in length, by 3–3.5 mm. in breadth. The number of segments varies from 100 to 105 according to individuals. The breadth of the body increases from the first to about the sixth segment, and then remain nearly the same until the seventeenth. The eighteenth segment has a pair of pad-like longitudinal ridges, on which account it is wider than any other segment. From the next succeeding segment (19th) the body tapers gradually towards the last, or anal, segment.

The *præstomium* (fig. 2, pr.) is present, but small, being separated from the first segment or the *peristomium* (fig. 2, per.) by two curved grooves, which converge posteriorly.

The *clitellum* (fig. 2, cl.) is well developed all around the body, occupying segments XII–XVII.

A pair of pad-like longitudinal ridges (figs. 1 & 3, p.) is developed on the ventral side of the eighteenth segment. They hang out on each side somewhat like the pads of a saddle. Its free edge is bent inwards, *i.e.* mediad, so as to overhang the male pores which open on that segment. The genital papilla (figs. 1 & 3, g.p.) occupies the ventral median portion of segments XIX and XX, both of which contribute to its formation. It is elliptical in outline, with the major axis disposed transversely and has a central depression.

The *setæ* are short and simple, arranged in eight series longitudinally, or in four pairs in each segment. The two setæ composing each ventral pair are nearer each other than those of the dorsal pair. From segment XXI posteriorly, each seta is furnished at its side with a shorter accessory one. No penial setæ are found in the neighborhood of the genital apertures.

The dorsal pores are absent.

The dorsal longitudinal blood vessel is single, giving off numerous lateral branches, or ventro-dorsal commissures. The two pairs of the latter, situated in segments XII and XIII are dilated (hearts), and are very conspicuous. A subneural blood-vessel does not exist in the present species.

The septa between the segments V–XIII are much thickened.

In the alimentary tract the calciferous glands are absent. The gizzard is but very feebly developed. The intestine begins in the fourteenth segment.

The *nephridia* are paired and commence in segment XIII. Their pores open in front of the outer of the ventral pair of setæ, and their funnels lie in the segment preceding that which contains the main mass of the organ. In segment XIV, the nephridia serve as oviducts.

The *spermathecæ* (fig. 4, sp.) occur in two pairs, in segments VIII and IX. Each spermatheca has a diverticulum in the same segment.

The *spermathecal pores* (fig. 1, sp.p.) are situated between segments VII/VIII and VIII/IX. They lie in front of and outside the outer of the ventral pair of setæ, surrounded by a conspicuous elevation of the body surface, so that they may easily be recognized at a glance. The elevations just mentioned as well as the two pads in segment XVIII, and also the genital papilla, are not well developed and therefore difficult to find in young specimens of 40 mm. or so in length.

The *ovaries* (fig. 4, o.), present in one pair, lie in segment XIII, and are connected with the peritoneal epithelium on the posterior side of the septum between segments XII and XIII. The ova are of various sizes but even the largest are furnished with little yolk, and they are never of considerable size. I have also observed some detached eggs in the cavity of segment XIII.

The *oviducal pores* (fig. 1, od.p.) open on segment XIV, in front and a little outside, of the inner of the ventral pair of setæ. The funnels of the oviducts are situated in segment XIII.

The *testes* (fig. 4, t.) are present in two pairs, in segments X and XI.

The *sperm-sacs* (fig. 4, sp.s.) likewise in two pairs, are racemose and lie in segments XI and XII. The spermatozoa are in various stages of development. Almost fully developed spermatozoa have also been observed in the body cavity.

The funnels (fig. 4, f.) of the spermducts are, as usual, provided with long cilia and lie in two pairs in segments X and XI. The *vas deferens* (fig. 5, v.d.) runs posteriorly, on each side as far as segment XVIII, where it enters the mass of the *spermiducal gland* (fig. 5, sp. gl. g.) in the neighborhood of the junction of the glandular and muscular portions of the latter, eventually to open into the lumen of the gland (figs. 5 & 6, sp. gl. c.)

There is only one pair of spermiducal glands. They belong to the tubular type (figs. 4 & 5) and occupy segments XVII–XIX, being much convoluted. Each gland consists, as already mentioned, of a glandular and a muscular portion, the latter leading to the exterior. At first, on dissecting the worm, it appeared to me as if the vas deferens opened at the junction of the two portions of the gland; but a close examination of serial sections has shown that this is not the case. The vas deferens is continued without interruption after joining the gland, and runs in the midst of the glandular cells towards the posterior blind end of the gland, tracing in general, the convolutions of the latter. It is at this end that the vas deferens really opens into the lumen of the gland. In other words the spermiducal gland is not a blind diverticulum but a direct continuation of the course, of the vas deferens. The glandular portion passes at the anterior end into the strongly muscular portion. The latter gradually tapers towards, and finally opens externally at, the male pore inside the pad-like ridge on segment XVIII.

The wall of the vas deferens is composed of a single layer of distinctly nucleated cells, and its inner surface is provided with long cilia (fig. 6, c. and w.v.d.) The glandular portion of the spermiducal gland consists of two distinct layers, the inner columnar epithelial layer, and

the outer thicker layer of more granular pear-shaped cells. The lumen is not ciliated. The part of the vas deferens enclosed in the spermiducal gland traverses the outer layer of the wall, so that in sections of the gland there appear two cavities, one that of the spermiducal gland and the other that of the vas deferens.

The ciliated epithelial wall of the vas deferens passes rather abruptly into the inner wall of the gland (fig. 6)

B. *Systematic position of the new species.*

From the above description, it is evident that this annelid belongs to the family Cryptodrilidæ, as defined by F. E. Beddard in his "Monograph of the Order of Oligochæta." The generic determination however offers some difficulty. The genus to which the present annelid comes very closely in several respects is undoubtedly *Pontodrilus*,* to which I refer it after all. But the one, by no means unimportant descrepancy consists in the fact that that genus has the "vasa deferentia opening at the junction of the glandular and muscular parts," whereas in the present species, the vas deferens distinctly opens into one end of the glandular portion of the spermiducal gland, the other end leading to the male pore,—a condition which obtains in the genera *Moniligaster* and *Ilyodrilus*, which however belong to families quite distinct from *Cryptodrilidæ*. In all other points the present species tallies well with the definition of *Pontodrilus* as given by Beddard. As the exact relation of the vas deferens and the spermiducal gland in *Pontodrilus* has probably never been subjected to careful examination by means of serial sections, the existing statement concerning it may be considered as open

---

* Beddard's definition of *Pontodrilus* :—

"Slender worms with eight setæ per segment, in pairs, the setæ of the dorsal pair being usually further apart than those of the ventral. No dorsal pores. Clitellum complete XIII–XVII. Male pores XVIII. Spermiducal gland tubular, vasa deferentia opening at junction of glandular and muscular parts. No penial setæ. Spermathecæ in VIII, IX, with single diverticulum. Gizzard absent or rudimentary; no calciferous glands. Nephridia commence in segment XIII or XV. No subnervian blood-vessel."

to doubt. I hold it highly probable that should known species of *Pontodrilus* be subjected to renewed investigations, the same condition as ascertained by me in the Japanese species will be revealed. With this belief I have preferred to refer my specimens to *Pontodrilus* rather than to create a new genus for its reception.

The species is certainly an undescribed one, so that I propose to call it *Pontodrilus matsushimensis.*

In conclusion I wish to offer my thanks to Prof. IJIMA for his kind supervision of my work.

November 23rd, 1897.

EXPLANATION OF PLATE II.

c.	Ciliation in vas deferens.
cl.	Clitellum.
f.	Spermduct funnels.
g.p.	Genital papilla.
m.	Male pore.
n.	Nuclei of the wall of vas deferens.
o.	Ovary.
od.	Oviduct.
od.p.	Oviducal pores.
op.	Opening of vas deferens into the spermiducal gland.
p.	Pad-like ridges.
per.	Peristomium.
pr.	Præstomium.
sp.	Spermathecæ.
sp.gl.	Spermiducal gland.
sp.gl.c.	Cavity of the glandular part of spermiducal gland.
sp.gl.g.	Glandular part of the spermiducal gland.
sp.gl.m.	Muscular part of the same.
sp.p.	Spermathecal pores.
sp.s.	Spermsacs.
t.	Testes.
v.d.	Vas deferens.
w.v.d.	Wall of vas deferens.

Fig. 1. Ventral view of *Pontodrilus matsushimensis*, nov. sp. 2/1.

Fig. 2. Dorsal view of the anterior end. $a_1 \times 1$ Zeiss.

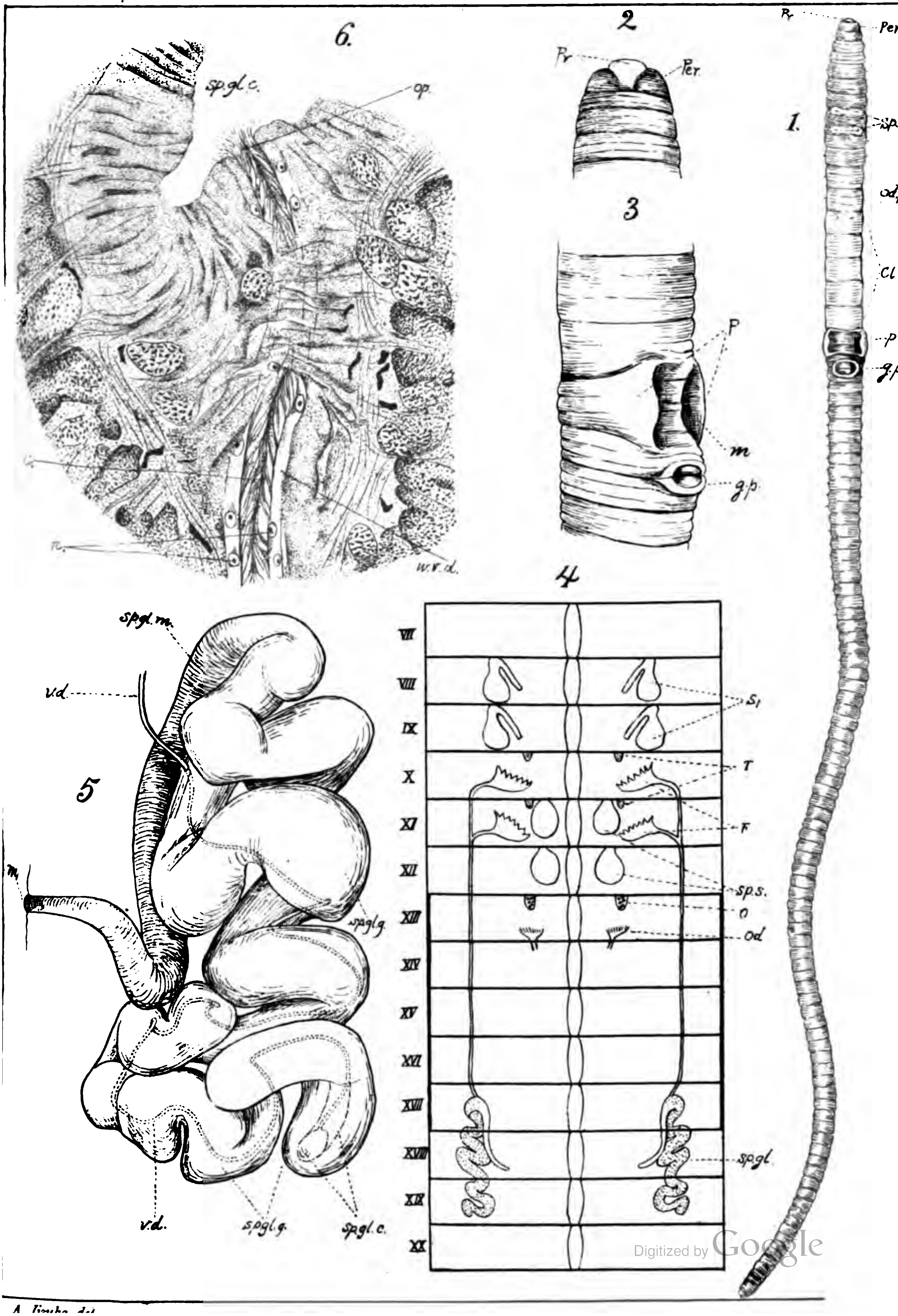
Fig. 3. Ventro-lateral view of the region succeeding the clitellum, showing the pad-like ridges and the genital papilla. $a_1 \times 1$ Zeiss.

Fig. 4. Diagram showing the positions of sexual organs.

Fig. 5. The left spermiducal gland seen from the left side, reconstructed from serial sections. 50/1.

Fig. 6. A section of a spermiducal gland showing the opening of vas deferens into the cavity of the glandular part of the spermiducal gland. $\frac{1}{12}$ hom. $\times$ 2 Zeiss.

Printed January 31, 1897.


6.
sp.gl.c.
op.
w.v.d.
2
Pr
Per.
3
P
m
g.p.
1.
Pr
Per
sp.p.
od.p
cl
p
g.p
4
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
s_1
T
F
sp.s.
O
Od
sp.gl.
5
sp.gl.m.
v.d.
m
sp.gl.g.
v.d.
sp.gl.g.
sp.gl.c.

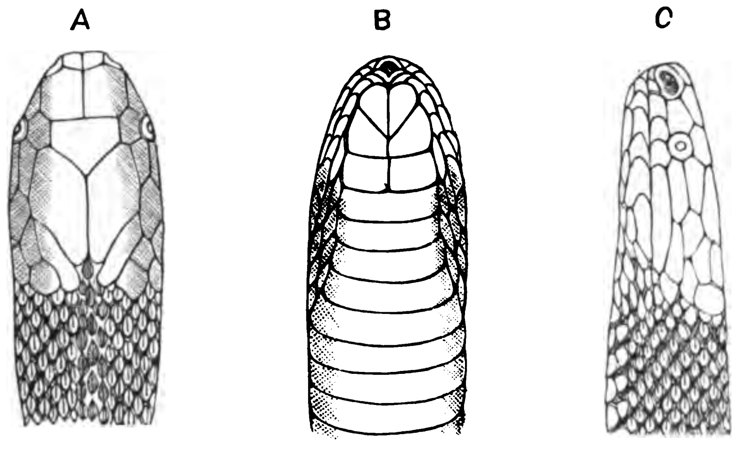
A. Iizuka del.

Ueber eine wenig bekannte einheimische Schlange der Gattung Achalinus (A. spinalis, Peters).

Von **M. Namiye.**

Zoologisches Institut der Kaiserl. Universität zu Tokyo.

Die folgende Beschreibung einer *Achalinus*-Art basirt sich auf zwei Exemplare, welche im vorigen Jahre von meinem Freunde, Herrn Nobumaro Takachiho, in der Nachbarschaft seiner Residenz zu Eihikosan in der Provinz Busen (Kiushiu) gefangen wurden. Der genannte Herr teilt mir mit dass diese Schlange in Kiushiu nur sehr selten vorkommt. Meines Erachtens stellt sie überhaupt eine ganz seltene Species dar, welche bis jetzt nur ein einziges Mal an die Hand eines Herpetologs gelang und deren Fundort auch mit Zweifel als Japan bezeichnet war. In dieser Sachlage wird eine erneute Beschreibung der mir vorliegenden zuverlässigen Materialien nicht ausser Stelle sein wird.



A, Kopf von oben, B, derselbe von unten, C, derselbe von links gesehe

Körper überall cylindrisch; Kopf schmäler als der Mittelteil des Körpers; Kopf und Hals ohne deutliche Begrenzung; Gaumen, Ober- und Unterkiefer mit kleinen Hakenzähnen versehen, die alle von gleicher Länge sind; kein Giftzahn.

Kopfschilder wie folgt: 1 Frontalschild, 2 Internasalschilder, 2 Praefrontalschilder länger als die Internasalschilder, 2 Supraocularschilder, 2 Parietalschilder, 1 Rostralschild, kein Præocularschild, 1 Frenalschild verlängert bis zum Auge, 2 Temporalschilder deren Vorderteile von Postocularschild nicht abgesondert sind, 2 Nasalschilder, 6 Supralabialschilder, 6 Sublabialschilder, 6 Inframaxillarschilder.

Schuppenreihen 23. Bauchschilder in einem Exemplar 163, im anderen 166, von denen der eine Analschild etwas länger als der andere ist. Postanalschilder 61 resp. 51 in einziger Reihe.

Kopf und Körper schwärzlich gelbbraun auf der Oberseite; eine schwärzliche Längsstreifung in der Mittellinie des Rückens vom Hinterkopf bis zu der Schwanzspitze. Der Bauchseite ist gleichmassig gelb, nur in der Mittellinie des Schwanzteils verläuft ein schwarzes unregelmässig markirtes Streif. Ueber die Farbe der Bauchfläche sei noch bemerkt dass sie im Leben heller ist, als bei den in Alkohol conservirten Exemplaren.

Gesammtlänge des einen Exemplars 408 mm., die des andern 405 mm., wovon 87 mm. resp. 75 mm. auf den Schwanz kommen.

Als ich zuerst ein einziges Exemplar dieser Schlange von Herrn TAKACHIHO erhielt, der dasselbe unserem Institut zum Geschenk brachte, wurde seine Bestimmung mir dadurch erschwert, dass sein Frontalschild sich doppelt darstellte, eine Erscheinung die bei den Colubriden als Ausnahme gilt. Da ich jedoch bald zufälligerweise erfuhr dass noch ein zweites Exemplar sich bei Herrn TAKACHIHO befinde, so wendete ich mich an ihn auch dasselbe mir zur Verfügung stehen zu lassen. Dieser Bitte kam er bereitwilligst entgegen, wofür ich hier meinen wärmsten Dank ausspreche. Dieses zweite Exemplar nun zeigte einen einzigen Frontalschild, und so wurde es klar gelegt dass das erste ein in diesem Verhältniss abnormes war—eine Ansicht

die schon vorher von Herrn DR. LEONHARD STEJNEGER, dem ich das erste Exemplar zeigte, ausgesprochen wurde.

Von den bekannten *Achalinus*-Arten nun giebt es drei, deren synoptische Merkmale im BOULENGER' schen "Catalogue" des Britischen Museums folgendermassen angegeben sind:

1. Scales in 25 rows; suture between the internasals longer than that between the præfrontals .... *rufesceus.*
2. Scales in 23 or 25 rows; suture between the internasals shorter than that between the præfrontals .... *braconnieri.*
3. Scales in 21 rows; Suture between the internasals as long as that between the præfrontals ... *spinalis.*

Von diesen drei Arten kommen unsere Exemplare der dritten am nähesten, einer Art, als deren Fundort "Japan (?)" angegeben ist. Jedoch bieten sie auch Verschiedenheiten dar; so in der Zahl der Schuppenreihen und in der relative Länge der Internasal- und Præfrontalnähte. Was den ersteren Punkt anbetrifft so sei bemerkt dass der Unterschied wohl der individuellen Variation zuzuschreiben ist; der zweite Punkt dagegen scheint von grösserer Bedeutung zu sein. Trotzdem sehe ich mich nicht veranlasst unsere Exemplare von *A. spinalis* specifisch zu trennen, obgleich sie vielleicht auch als eine Unterart derselben vorgestellt werden dürfen.

Abgedruckt 23. Februar, 1898.

ON THE AFFINITY OF OUR WILD AND DOMESTIC SILKWORMS.

By **C. SASAKI.**

Professor of Entomology, Agricultural College, Imp. Univ., Tokyo.

With Pl. III.

The wild silkworms, which are vulgarly called *Kuwako, Kuwaoko,* or *Noraoko,* are widely distributed in almost all parts of our empire, where mulberry trees are planted. They are more or less found on the trees every year, but they do no greater harm than the other lepidopterous larvæ that are found feeding on the same trees.

The eggs of the wild silkworms hatch out usually in the latter part of April, nearly at the same period with our domestic form (*Bombyx mori, L.*). From the end of June to July, they, becoming mature, spin a light yellowish cocoon within a folded leaf. The winged insects may appear at the end of two or three weeks after the formation of the cocoon, and lay eggs on branches or twigs of mulberry trees. The eggs hatch out in from two to three weeks after they are laid; but the hatching is sometimes much delayed. Thus the growth of the larvæ becomes very irregular, as we meet with various stages of their growth within the same period, and consequently the winged insects begin to appear in September, and continue to do so till November. The eggs deposited by these on the stems or branches of mulberry trees, pass the winter and hatch out in the following spring.

It seems however that the moth breed generally twice in a year, or even more frequently in a more favorable condition.

On the wild silkworms, Mr. H. Pryer wrote some accounts in his catalogue of the lepidoptera of Japan, in which he says: "*Bombyx sp.* Yokohama; a wild form of the cultivated silkworm. The larva and imago are considerably darker; it spins a much lighter cocoon than the domesticated insects; feeds on the mulberry." This is all that he wrote on the wild silkworm, and he did not in-

stitute a detailed comparison with the cultivated form.

If we now compare the adult of our wild silkworm with *Theophila mandarina*, which Mr. F. MOORE has described in the extract of the Proceedings of the Zoological Society of London, April 1872, we can not find any difference between the two. His description is:—"Female grey: fore wing with a well-defined antemedian curved transverse brown band, and a transverse postmedian suffused brown line, beyond which is a submarginal white-bordered recurved narrow line, outside of which is a suffused brown patch below the apex; discocellular mark indistinct: hind wing brown, with a whitish submarginal line, and two white spots on abdominal margin: thorax brown, waist band grey; antennæ fuliginous, shaft grey."

In the "Bulletin des Soies et des Soieries", 26 September 1885, in T. WARDLE's Handbook of the Collection illustrative of the wild silks of India" and also in "Bolletino Mensile di Bachicoltura" No. 2, 1886, are mentioned some accounts on *Theophila mandarina*, but its specific characters are not described.

In the following lines, I will mention the specific characters of the adult of our wild silkworms as well as its eggs, larvæ, cocoon and pupa in order to compare with those of *Theophila mandarina*, which is said to be commonly found on mulberry trees in China.

If we now compare the adult of our wild silkworm with *Theophila mandarina*, it will be found that both, agreeing in their specific characters, belong undoubtedly to one and the same species.

The adult of our wild silkworms has the following characters:—

Female light brownish grey; fore wing light greyish brown with two not well defined recurved bands, of which the inner (antemedian) is brown, while the outer (postmedian) is much lighter in color. The outer edge of the postmedian band is bordered on its distal edge with a dark brownish line, along its outside runs a white recurved line. A portion of the wing lying just below the apex is slightly indentated, and the latter is bordered with a blackish brown patch. Discocellular mark lying between the two brownish bands indistinct. The principal veins of the fore wing are six; namely costal, subcostal, radial, medial, cubital and anal, all of which arise near the base of the wing (fig 2). Hind wing light brown with its outer half colored dark brown, and in the centre there

runs a broad band lined with blackish rims. The abdominal margin blackish brown with two small white markings. Antennæ brown, pectinated, its teeth are shorter than in the male, and its shaft greyish.

Length of the body 20 mm. Expansion of wings 44 mm. (fig. 1, a).

Male greenish brown, fore and hind wings brownish yellow. The two brownish transverse bands, a discocellular mark and a dark brownish patch bordering the indentation lying below the apex of the fore wing deeper in color and much more distinct than in the female. The indentation deeper, the markings of the hind wing more distinct, and the teeth of pectinated antennæ longer than in the other sex. Length of the body 15 mm. Expansion of wings 39 mm. (fig. 1, b).

The eggs are deposited in groups on the stems or branches of mulberry trees. They are oval, somewhat flattened, and of a light yellowish grey color. Their longer and shorter axes are respectively 1.7 mm. and 1.5 mm. The lower surface of eggs i.e. the one by which they are attached to mulberry trees, is flattened, while the centre of the opposite surface is usually more or less depressed.

Larva of the first stage (that is before the first moult) is about 5 mm. in length and has a quite different aspect from that of the following stages (fig. 3).

It has a large blackish head, while the body segments are light blackish. A few segments which follow the head are broader than the latter; but the remaining segments are gradually reduced in size towards the posterior end. The anterior half of the 1st segment of the body is greyish white, and the 2nd, 4th, 6th, 7th and 8th segments are decorated with greyish yellow symmetrical markings. Although the remaining segments bear also similar symmetrical markings, these are more or less indistinct.

On the subdorsal lines of each segment of the body except the 11th, there lies a pair of turbercles provided with a few blackish long hairs bearing short fine prickles; while the 11th bears only a single hair bearing turbercle.

The supra- and infra-stigmatic as well as the basal lines of each segment bear each a single tubercle, which bears also a few long hairs of the same nature as those mentioned above.

After the first moult, the larva becomes naked by losing all its long hairs, and the color as well as the markings are entirely different from those of the previous stage.

After the second stage there are no marked changes in both color and markings till the larva becomes mature.

The mature larva is long cylindrical and 51 mm. in length. The head is comparatively small, somewhat depressed, and light greenish yellow in color. The body is light greenish brown in color, but it looks somewhat dusky, since it is provided with several markings of different kinds, sizes, and colorations (fig. 4).

The principal markings of the body are:—the first body segment deep greenish yellow in its posterior half, the 2nd bears dorsally a large central greenish yellow, and two smaller lateral blackish, patches. The front and lateral sides of the central patch are tinged black. Tht boundary lines between the central and the two lateral patches as well as the posterior edges of the same segment are tinged crimson red. The 3rd and 4th segments deep greyish brown, and the former is provided with a few deep folds. The body segments from 5th to 10th bear each a * shaped deep greyish markings, which are either somewhat distinct or obscure.

The 5th and 8th body segments bear dorsally a pair of oval patches of a light dull brownish color. Each of the patches on the 5th segment (fig. 4, a) is bordered with an imperfect blackish ring. In the centre of the patch lies a black dot, while the rest of the patch which occupies the larger portion of it, is marked with a few dull purplish elongated areas. The portion of the patch, where the purplish long pieces are wanting, is usually provided with a variable number of white dots. The patch of the 8th segment has a small central dull purplish dot, and the remaining portions are occupied with 3 or 4 short rod-like markings of the same color (fig. 4,b).

The cocoon is elongated oval or rather spindle shaped in form, and of a light yellowish color. The length is about 30 mm. and the breadth 12 mm.

It is usually enclosed in a leaf of the mulberry tree, and hangs on the twigs. The pupa is cylindrical, dark brown, about 20 mm. in length.

The adult of the domestic silkworm (*Bombyx mori*) is mostly white, and larger than that of the wild silkworm. The fore wing is also white; but just below its apex there lies a slight indentation exactly similar to the one found on the fore wing of the wild silkworm moth. The ante- and postmedian bands as well as the discocellular mark, are, in certain individuals, distinctly seen; but a blackish brown patch bordering the indentation below the apex is entirely

absent. The two bands and the discocellular mark above mentioned are colored dull brown (fig. 5, b). In some specimens, each of the ante- and postmedian bands is represented by 2 parallel recurved brownish lines and a discocellular mark is still conspicuous (fig. 5, a). In others, the antemedian band is absent, and only a single recurved light brownish line indicating the inner edge of the postmedian band, and a light brownish discocellular mark are present (fig. 6, a & b). In still others, the recurved line indicating the inner edge of the postmedian band has almost disappeared, while the discocellular mark remains in the form of a faintly colored dot (fig. 7, a & b). Finally even the discocellular mark disappears, and there is no longer found any colored band, patch or dot, and the fore wing looks entirely white (fig. 8, a & b). The venation of the fore wing is exactly similar with that of the adult of the wild silkworm, both being provided with six principal veins—costal, subcostal, radial, medial, cubital, and anal (fig 5, c).

The hind wing is also white, and in its centre runs a light brownish band, which is distinctly seen on the hind wing of the wild silkworm moth (fig. 6, b). In some specimens a part of the band loses its color, while in others the band nearly disappears; but its position is still represented by a single recurved light brownish line, indicating the other edge of the band (fig. 7, b). In still others, there is no longer to be seen even a trace of the band. Further, the abdominal margin of the hind wing is marked with a single blackish dot instead of three which are regularly found on the same region of the hind wing of the wild silkworm moth. In some individuals, the blackish dot becomes very faint while in others it entirely disappears (figs. 5, 6, 7, & 8).

The other characters are exactly same in the moths of both the wild and domestic silkworms

The body of the female is larger than that of the male, and the teeth of its pectinated antennæ are shorter than in the other sex.

The length of the female of our largest race is about 24 mm. and the expansion of wings 46 mm., while that of the male is about 17 mm. and the expansion of wings nearly same as in the female.

The eggs are almost exactly similar in form and size with those of the wild silkworm moth, but they differ in their being purplish blue in the latter (in a race of greenish cocoon they have a greenish shade).

Larva of the first stage about 4 mm. Coloration of the head and body as

well as number and arrangements of tubercles on the segments, are also very similar to those of the wild silkworm; but there are no colored symmetrical markings on the body (fig. 9).

The mature domestic silkworm is long cylindrical, and the length of the body of our largest variety measures about 65 mm. The so called *Kumako* race (race of two breeds) has a close resemblance to the wild silkworm both in its coloration and the form and arrangement of its patches. Although this race shows various modifications in color and markings, most of the individuals are greyish brown, with a light greenish shade. The first body segment is tinged greyish yellow in its posterior half, just like the wild silkworm; 2nd has dorsally a central dark greyish brown patch with blackish lateral rims, and 2 lateral blackish patches. The intervening line between the central and lateral markings is white, with a faint reddish shade. The 5th to 10th segments bear each a ∧ shaped light greyish yellow marking; but the latter is in most cases not so well defined as in the wild silkworm (fig. 10, a, b, c).

The 5th and 8th body segments bear a pair of imperfect oval patches which are also found in the wild silkworm. That on the 5th segment is light dull brown, and one end of a black line which does not completely surround the patch, runs in towards the middle of the patch, thus dividing it into two portions, in one of which lie 4 or 5 dull purplish dots, while in the other a few white dots. The patch on the 8th segment is elongated oval or more or less so. It is also light dull brown, and is sorrounded by a blackish line. In this patch lies a variable number of dull purplish dots arranged in a single series.

In the race *Akabiki* (a largely cultivated race of a single breed), the body is white, and the posterior half of the 1st body segment is tinged yellow. The markings of the 2nd as well as of the 5th and 8th segments are also distinctly seen, but those on the latter two segments are more or less modified in different individuals (fig. 11, a & b).

In the race *Kimai* (race of greenish cocoon), the body is also white, the marking on the 1st body segment is light. The central marking on the 2nd segment is light greenish yellow, while the two lateral markings on the same are represented each by a simple greyish dot. Each marking on the 5th segment which is oval and light greenish in color, contains a hook shaped, light greenish, curved line instead of dull purplish dots. That on the 8th segment is either oval or

round and contains a single elongated dot of a light greenish color (fig. 12, a & b).

The cocoon is elongated oval with a slight constriction near its middle, but in certain Chinese cocoons the constriction is absent and the cocoon thus assumes a spindle form. The color is either white, green or yellow. The spindle shape and the greenish color of a cocoon, are points of very close resemblance to that of the wild silkworm. The cocoon of the domestic silkworm are very variable in size, but that of our largely cultivated race is about 33 mm. in length.

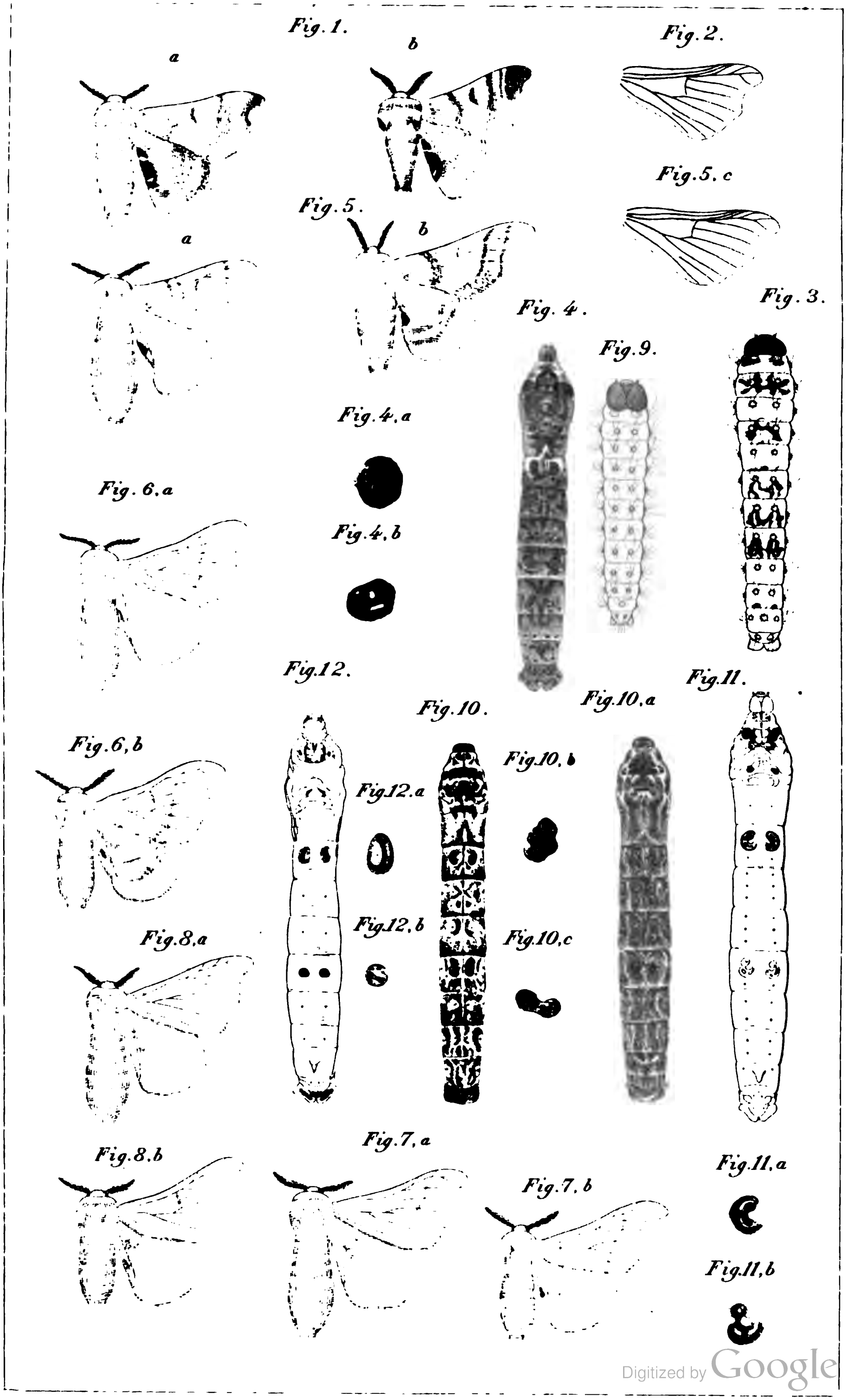
Thus the adult of the cultivated silkworm has exactly similar characters, i.e. markings, venations &c. with that of the wild form, but it differs from the latter in the size and coloration as well as the lighter color of markings, but these are unquestionably variations that occurred under domestication for a long interval of time, and moreover, various transitional forms of the markings and coloration prevalent among the adult of the domestic silkworm affords a strong evidence, that the latter has been derived from the silkworm living wild still at present. Further, the egg, larva, and cocoons are nearly same in forms, markings, and coloration in both the wild and domestic forms, and the differences can be seen only in a lighter coloration, more or less imperfect markings, and size.

The above mentioned facts lead us to conclude that the domestic silkworm has been derived from the wild form which belongs to exactly the same species with the *Theophila mandarina* described by Dr. F. Moore, and the latter is nothing else than the ancestral form of our domestic silkworm.

EXPLANATION OF PL. III.

Fig. 1, a.	*Theophila mandarina*, Moore,	♀. 1/1.
Fig. 1, b.	" "	♂. 1/1.
Fig. 2.	Fore wing of ditto showing venation. 1/1.	
Fig. 3.	Larva of the first stage of ditto. 15/1.	
Fig. 4.	Mature larva of ditto 1/1 ; a, patch on the 5th segment, b, same on the 8th segment, slightly magnified.	
Fig. 5, a.	*Bombyx mori*	♀. 1/1.
Fig. 5, b.	Ditto	♂. 1/1.
Fig. 5, c.	Fore wing of ditto showing venations. 1/1.	
Fig. 6, a.	*Bombyx mori*	♀. 1/1.
Fig. 6, b.	Ditto	♂. 1/1.
Fig. 7, a.	Ditto	♀. 1/1.
Fig. 8, b.	Ditto	♂. 1/1.
Fig. 9.	Larva of the first stage of *Akabiki* race, 10/1.	
Figs. 10, and ditto a.	Two forms of mature larva of *Kumako* race 1/1 ; b, patch on the 5th, c, the same on the 8th segments, slightly magnified.	
Fig. 11.	Mature larva of *Akabiki* race, 1/1 ; a, patch on the 5th ; b, the same on the 8th segment, slightly magnified.	
Fig. 12.	Mature larva of *Kimai* race 1/1, a, patch on the 5th ; b, the same on the 8th segment, slightly magnified.	

Printed May 25th, 1898.



Lith et Imp E. Koshii

THE GENERA AND SPECIES OF ROSSELLIDÆ.

(Preliminary Notice.)

By Prof. I. Ijima, Ph. D.

Having finished sometime since my studies of the Rossellid materials contained in the Science College Museum, I propose to give here a brief notice of the results arrived at with respect to the system of family Rossellidae. Taking into account the characters of not only parenchymal microscleres, but also as far as possible of megascleric elements, I have been led to divide the family into four subfamilies, synoptically shown as follows:

a′. Dermalia not differentiaded into autodermalia and hypodermalia. No oxyhexaster present among intermedia..............A. *Leucopsacinæ.*
a″. Dermalia differentiated into autodermalia and hypodermalia. Oxyhexaster generally present among intermedia.
  b′. Without octasters.
    c′. With plumicomes; with or without oxyhexasters..........B. *Lanuginellinæ.*
    c″. Without plumicomes; oxyhexasters always present.......C. *Rossellinæ.*
  b″. With octasters; oxyhexasters always present.........................D. *Acanthascinæ.*

The definition of the family itself may remain as it stands (F. E. Schulze, Revision d. Syst. d. Asconematiden u. Rosselliden. Sitz.-ber. k. pr. Akad. Berlin, 1897).

A. LEUCOPSACINÆ.

Dermalia not distinguishable into autodermalia and hypodermalia, but consist of large pentactins, which are but little differentiated from parenchymal megascleric hexactins beyond the total absence of sixth, distally directed rays.* Gastralia, hexactins or pentactins, or both. Parenchymal megascleres contain large or medium-sized hexactins (except in *Caulocalyx*), together with diactins in

---

* This character of dermalia and the presence of well-developed hexactins as parenchymal megascleres probably represent a more primitive condition than what we find in other subfamilies.

greater or less quantity. As intermedia there are only discohexasters or their modification, usually in one or two kinds (macrodiscohexasters and microdiscohexasters.)

Artificial Key to Genera and Species.

a′. Parenchymal megascleres extensively fused together
  b′. Discohexaster in one kind. .... *Euryplegma auriculare.*
  b″. Discohexaster in two kinds (including "rhopalaster")...... *Aulocalyx irregularis.*
a″. Parenchymal megascleres loose (except at surface of attachment).
  b′. Dermalia pronged.. *Caulocalyx tener.*
  b″. Dermalia without prongs.
    c′. With hexactinose discohexaster.
      d′. Rays of parenchymal hexactins straight.................. *Leucopsacus orthodocus.*
      d″. Rays of parenchymal hexactins curved............. ..... *Leucopsacus scoliodocus.*
    c″. Without hexactinose discohexaster.
      d′. Discohexaster in one kind.................................... *Placopegma solutum.*
      d″. Discohexaster in two kinds (minute clavicome and very large discohexaster with anchor-like terminal discs)... *Chaunoplectella cavernosa.*

Leucopsacus, n. g.

Small, sack-like forms with smooth surface. Parenchymal megasclores consist chiefly of hexactins; diactinic parenchymalia present, but play a subordinate part. Intermedia are usually of two kinds: *macrodiscohexaster* hexactinose, i. e., six-armed as in a regular hexactin; each arm, or more properly terminal, ends with an anchor-like umbel of 3—5, strong teeth†; length of arm 50—90 μ. *microdiscohexaster*, of variable shape and size. Gastralia are usually hexactins, differing in no way from those of parenchymalia.

1. ***L. orthodocus***, n. sp.

Body ovoid, with stalk-like base; 10 mm. long. Rays of dermal pentactins and of parenchymal or gastral hexactins straight. Hexactinose macrodiscohexaster as already characterized. Microdiscohexaster 50—88 m in diameter; each short principal with 4—8 slender terminals, which together from a bell-shaped perianth; terminal disc with 5 or 6 minuts teeth.

Loc.: Sagami Sea.

† The spicul here characterized has been figured by Schulze, Chall. Rep. Hex. Pl. LV, fig. 8. In this peculiar modification of discohexasters the axial cross is confined to the centre.

2. ***L. scoliodocus,*** n. sp.

Globular or ovoid sack, up to the size of a hazel-nut. Rays of dermal pentactins straight, but those of parenchymal and gastral hexactins curved. Hexactinose macrodiscohexaster as in foregoing species. Microdiscohexaster spherical, 46—70 μ or more in diameter; each short principal bearing 4—10, straight or nearly straight terminals; discs about equidistant at the peripheral surface of the spicule, toothed. Of inconstant occurrence is a third modification of discohexasters, which I should call *clavicome.* This most nearly resembles the sigmatocome of SCHULZE. Diameter 38—50 μ; principal takes about ¼ of a ray and bears a narrow perianth of very slender, terminally swollen terminals set in a single whorl.

Loc.: Sagami Sea; found attached to *Hexactinella lorica,* Ij. MS.

CHAUNOPLECTELLA, Ijima.

Thick-walled goblet of egg-like shape, attached by a short stalk-like base. Parenchymal megascleres, chiefly hexactins and diactins with bent rays. Intermedia, of two kinds: large macrodiscohexaster and small clavicome.

3. ***C. cavernosa,*** Ijima.

Ijima (Zool. Anz., p 250).

Loc.: Sagami Sea.

PLACOPLEGMA, F. E. Sch.

4. ***P. solutum,*** F. E. Sch.

Schulze (Hex. Ind. Oc., II., p. 63, pl. VI. 11—77). (Rev. Asc. u. Ross., p. 544).

Loc.: Bay of Bengal.

AULOCALYX, F. E. Sch.

5. ***A. irregularis,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 174, pl. 174, pl. LX).—(Revision Asc. u. Ross., p. 544).

Loc.: off Marion Island, SE of Cape of Good Hope.

EURYPLEGMA, F. E. Sch.

6. ***E. auriculare*, F. E. Sch.**

Schulze (Chall. Rep. Hex., p. 176. pl. CII). (Rev. Asc. u. Ross., p. 545).

Loc.: NE of New Zealand.

CAULOCALYX, F. E. S.

7. ***C. tener*, F. E. S.**

Schulze (Chall. Rep. Hex., p. 172, pl. LXIX). (Rev. Asc. u. Ross., p. 549).

This species seems to occuppy an isolated position in this subfamily, particularly on account of the fact that hexactins are not known to occur among its parenchymal macroscleres. The "aspidoplumicome" of this species is undoubtedly closely related to the plumicome of *Lanuginellinæ* and, in my opinion, also to what I have called clavicome in *Leucopsacus scoliodocus* and *Chaunoplectella cavernosa*.

Loc.: W. of Tristan d'Acunha.

B. LANUGINELLINÆ

Dermalia with stauractinic or pentactinic autodermalia and larger pentactinic hypodermalia. Gastralia, hexactins. Parenchymal megascleres consist of diactins and of large or medium-sized hexactins. Plumicome always present among intermedia, which for the rest consist of either discohexaster or oxyhexaster, or of both.

Artificial Key to Genera and Species.

a'. Firmly attached to solid substratum. No oxyhexaster ..... *Lanuginella pupa.*
a''. Rooted in loose bottom by basal tuft of anchor-like spicules. Oxyhexaster present.
 b'. Dermalia, stauractins. Intermedia in two kinds (oxyhexaster and plumicome) .... *Lophocalyx philippinensis.*
 b''. Dermalia, pentactins. Intermedia in three kinds (oxyhexaster, discohexaster and plumicome) .... *Mellonympha velata.*

LANUGINELLA, O. Schm.

8. ***L. pupa*, O. Schm.**

O. Schmidt (Spong.—Fauna Atl. Geb, p. 13, T. II, 1, 3).—W. S. Kent (Mouthl. Micr. Journ. 1870, p. 247, pl. LXV, 1—7):—Schulze (Chall. Rep. Hex., p. 130, pl. LIII 3—5).—(Rev. Asc. u. Ross., p. 548).

Loc.: Atlantic; off Little Ki Island; Sagami Sea

LOPHOCALYX, F. E. Sch.

9. ***L. philippinensis*** (Gray).

Rossella philippinensis, J. E. Gray (Ann. & Mag. Nat. Hist., 1872, Ser. IV, Vol. X., p. 137). &c.—*Psetalia globulosa*, Gray (ibid., 1873, Vol. XI., p. 234). &c.—*Lophocalyx philippinensis*, Schulze (Chall. Rep. Hex., p. 133, pl. LIII. 1—2, pl. LIX). (Rev. Asc. u. Ross., p. 546).

Loc.: Philippine Islands; Little Ki Island.

MELONYMPHA, F. E. Sch.

10. ***M. velata*** (W. Thoms.)

Rossella velata, W. Thomson (Depth of the Sea, p. 418, fig. 65). Schulze (Chall. Rep. Hex., p. 143).— *Melonympha velata*, Schulze (Rev. Asc. u. Ross., p. 547).

Loc.: Strait of Gibraltar.

C. ROSSELLINÆ.

Autodermalia variable. Pentactinic hypodermalia generally present, sometimes wanting. Gastralia, hexactins, sometimes pentactins Parenchymal macroscleres, chiefly diactins, may however enclose medium-sized or small hexactins. As intermedia, oxyhexasters absent or more generally present in one or two kinds.

Artificial Key to Genera.

a′. Hypodermal pentactin wanting.
  b′. Sack-like or vase-like forms without distinct stalk.............*Aulosaccus.*
  b″. Body with gastral surface everted so as to form a large part of the outer surface; with long, tubular stalk...............*Aulochone.*
a″. Hypodermal pentactin present.
  b′. Intermedia, only oxyhexaster..*Bathydorus.*
  b″. Intermedia include discohexaster besides oxyhexaster.
    c′. Discohexaster in one kind.

d′. Autodermalia; pentactins with boss-like rudiment of distal sixth ray; occasionally hexactins.....................*Hyalascus.*
d″. Autodermalia stauractins or pentactins, or both; without rudiment of distal ray and never hexactinic.
e′. Forms without distinct stalk.................................*Vitrollula.*
e″. Forms with long, distinct stalk.................................*Crateromorpha.*
c″. Discohexaster in two kinds...*Rossella.*

Bathydorus, F. E. Sch.

Autodermalia, diactins, stauractins or pentactins. Hypodermal pentactin present. Gastralia, probably always hexactins. Parenchymal megascleres with or without hexactins. Intermedia, oxyhexaster only.

Artificial Key to Species.

a′. Autodermalia, almost exclusively straight diactins..............*B. baculifer.*
a″. Autodermalia, predominatingly stauractins.
b′. General surface smooth, without diactinic prostalia.
c′. Cup-like forms, expanded above and without marginal fringe of spicules..*B. laevis.*
c″. Tubular forms, with a fringe of marginalia.....................*B. fimbriatus.*
b″. General surface with diactinic prostalia.
c′. Oxyhexaster with principals exceedingly shortened as to be almost annulled..*B. stellatus.*
c″. Oxyhexaster with distinct cylindrical principals.........*B. spinosus.*

11. ***B. fimbriatus,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 152, pl. LVIII). (Rev. Asc. u. Ross., p. 533).

Loc.: North Pacific.

12. ***B. stellatus,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 152, pl. LIX 1—5). (Rev. Asc. u. Ross., p. 534).

Loc.: Messier Channel in Patagonia.

13. ***B. spinosus,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 153, pl. LIX 6—9). (Rev. Asc. u. Ross., p. 534).

Loc.: Pinguin Islands.

14. ***B. baculifer,*** F. E. Sch.

Schulze (Chall Rep. Hex, p. 154, pl. LIX 10—18). (Rev. Asc. u. Ross., p. 535).

Loc.: South Pacific.

15. ***B. laevis,*** F. E. S.

Schulze (Hex. Ind. Oc., II, p. 57, T. VI 1—10). (Rev. Asc. u. Ross., p. 535).

Loc.: Bay of Bengal.

VITROLLULA, n. g.

Autodermalia, stauractins or stauractins and pentactins. Hypodermal pentactin present. Gastralia, hexactins and pentactins. Parenchymal megascleres with or without hexactins. Intermedia, of oxyhexaster and discohexaster; the latter in one kind.

This genus is closely related to *Crateromorpha,* but is distinguishable by the absence of distinct stalk to the sponge body.

16. ***V. fertile,*** n. sp.

Body ovoid or spindle-shaped, attached by one end to firm substratum; small, up to 15 mm. in total length. Autodermalia, of sparingly rough stauractins with rays 180—340 μ long. Hypodermal pentactin moderately large. Gastralia, hexactins and pentactins occurring in a sparing number. Parenchymal megascleres, chiefly diactins, but hexactins are of common occurence amongst them. Intermedia of two kinds: *Oxyhexaster,* 120 μ in average diameter; each short principal bearing 4—7, slender, straight, rough-surfaced, divergent terminals. *Microdiscohexaster,* of usual shape, 26—30 μ in diameter.

All specimens examined contained numerous larvae in various stages of development. These are at a certain stage spherical, covered externally by ciliated cell-layer and contain internally a mass of cells. Stauractinic spicules are the first that appear in the periphery of the internal mass. Later, the larvae are spindle-shaped, thickest nearer to one end.

Loc.: Sagami Sea.

17. ***V. namiyei***, n. sp.

Slightly compressed sack with broad irregular base and a firm wall of moderate thickness. Dimensions, 76 mm. high and 30—56 mm. broad. The sponge has tendency to produce secondary oscula or persons by budding or division. Autodermalia consist of stauractins and pentactins with stout, strongly prickly rays, 90—165 μ long. Gastralia, of pentactins and hexactins, constituting a continuous antogastral layer. Parenchymal megascleres are exclusively diactins. Intermedia: *Oxyhexaster*, 52—76 μ in diameter; each very short principal bearing 2—4, diverging, nearly straight, minutely prickly terminals. *Discohexaster* spherical, 50—100 μ in diameter; principals exceedingly short, each with 3—5 or more, slender terminals that end with distinctly toothed discs.

But for the absence of a distinct stalk and the presence of hexactinic antogastralia, this species might be put under *Crateromorpha*.

Loc.: Sagami Sea.

CRATEROMORPHA (J. E. Gray) Carter.

Autodermalia, hypodermalia and intermedia as in foregoing genus. Gastralia, pentactins; occasionally stauractins. Sponge-body with distinct narrow stalk, which generally contains a system of anastomosing canals.

Artificial Key to species.

a'. Autodermalia, stauractins and pentactins.
  b'. The wall with a system of anastomosing intercanals; through-going passages present at the junction of body with stalk...*C. corrugata.*
  b''. Without above-mentioned characters.
    c''. Microdiscohexaster spherical; stalk with anastomosing canals...*C. meyeri.*
    c'. Microdiscohexaster with each bunch of terminals making a prominence at surface; stalk simply tubular............*C. thierfelderi.*
a''. Autodermalia, exclusively pentactins; hypodermal pentactin unusually thick-rayed...*C. pachyactina.*
a'''. Autodermalia, almost exclusively stauractin; discohexaster thick-rayed...*C. tumida.*

18. ***C. meyeri*** (J. E. Gray) Carter.

Carter, Gray, etc.—Schulze (Chall. Rep. Hep. Hex., p. 161, pl. LXI). (Rev. Asc. u. Ross., p. 540).

Loc.: Philippine Islands; Sagami Sea.

Besides typical *C. meyeri* there occur in Sagami Sea two varieties:

a. *C. meyeri* var. *tuberosa.*

Larger than typical *meyeri*; 200 mm. or more in height. The wall projects externally in a number of small or large, irregularly rounded, hillock-like or tubercle-like prominences. A large quantity of diactins enters into the composition of hypodermal strands; otherwise of essentially same spiculation as in typical species.

β. *C. meyeri* var. *rugosa.*

Also larger than typical *meyeri*; almost a foot in height. The wall with irregular prominences, while the general surface is extremely uneven on account of numerous wrinkle-like ridges. Spiculation as in var. *tuberosa.*

19. ***C. pachyactina,*** n. sp.

Shape and size like *C. meyeri* var. *tuberosa* or *rugosa.* Sponge of rather compact texture, with scanty narrow afferent apertures. Both autodermalia and gastralia are pentactins. Hypodermal pentactins strong, unusually thick-rayed (⅓ mm. thick with ray length of 2¾ mm.). Intermedia as in *C. meyeri.*

Loc.: Tosa Sea (Shikoku).

20. ***C. corrugata,*** n. sp.

Sponge-surface with numerous pit-like or irregular depressions leading into a system of anastomosing intercanals. Through-going passages present at the junction of body with stalk, i. e., the latter divides into a number of branches at the upper end. Up to about a foot in height. Autodermalia stauractins and pentactins, the former predominating. Gastralia, mostly stauractins. Intermedia resemble those of *C. meyeri* or *C. pachyactina.*

Loc.: Sagami Sea.

21. ***C. thierfelderi,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 164, pl. LXII 1—4). (Rev. Asc. u. Ross., p. 540):—*C. murrayi,* Schulze (Chall. Rep. Hex., p. 164, pl. LXIII).

Loc.: Little Ki Island.

22. ***C. tumida,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 166, pl. LXVII and pl. LXVIII 2). (Rev. Asc. u. Ross., p. 541).

Loc.: Banda Islands.

AULOCHONE, F. E. Sch.

Autodermalia and gastralia, predominantly or exclusively pentactins. Hypodermal pentactins wanting. Parenchymal megascleres without hexactins. Sponge-body with gastral surface everted to a great extent so as to form a large part of the external surface; with long tubular stalk.

23. ***A. cylindrica,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 168, pl. LXVI and pl. LXVIII 1).—*Crateromorpha cylindrica*, Schulze (Rex. Asc. u. Ross, p. 542).

Loc.: NE of Kermadec Islands.

24. ***A. lilium,*** F. E. Sch.

Schulze (Chall. Rep. Hex., pl. 171, pl. LXVIII 3—7).—*Crateromorpha lilium*, Schulze (Rev. Asc. u. Ross., p. 542).

Loc.: Meangis Islands, NE of Celebes.

HYALASCUS, Ijima.

Autodermalia, pentactins with distally directed sixth ray represented by a knob-like boss; occasionally genuine hexactins. Pentactin hypodermalia present. Gastralia hexactins. Parenchymal megescleres, solely diactinic. Intermedia of two kinds: *Oxyhexaster* with 1 or more and often all principals bearing only one terminal (hemi-oxyhexaster and hexactinose oxyhexaster). *Discohexaster* of small or moderately large size. Sponge-body probably unstalked, vase-like.

This genus is decidedly to be taken up in *Rossellinæ*, notwithstanding the occasional occurrence of hexactinic autodermals.

25. ***H. sagamiensis,*** Ijima.

Ijima (Zool. Anz., 1896, p. 251).

Loc.: Sagami Sea.

26. ***H. giganteus,*** n. sp.

Known to me by a very large fragment of light, cavernous texture. Efferent apertures on gastral side as large as 18 mm. in diameter, covered over by an irregularly meshed lattice-work consisting mainly of strands of hypogastral di-

actins. Afferent apertures smaller. Spiculation similar to that of foregoing species, but rays of autodermalia and autogastralia almost smooth at base; intermedial oxyhexaster 76—103 μ in diameter; discohexaster 60—76 μ in diameter, with about 6 slender terminals to each principal.

Loc.: Sagami Sea.

ROSSELLA, Carter.

Autodermalia, stauractins or pentactins. Hypodermal pentactin present. Gastralia, hexactins. Parenchymal megascleres may contain hexactins of medium size or under. Intermedia consist of oxyhexaster and of two kinds of discohexasters (macrodiscohexaster and microdiscohexaster).

27. ***R. antarctica,*** Carter.

Carter (Ann. and Mag. Nat. Hist., 1872, p. 409). Schulze (Chall. Rep. Hex., p. 139, pl. LV). (Rev. Asc. u. Ross., p. 536).—*Acanthascus grossularia,* Schulze (Chall. Rep. Hex., p. 145, pl. LVI).

Loc.: S. of Kerguelen Isl.; SE of Prince Edwards Isl.; Possession Isl.

28. ***R. longispina,*** Ijima.

Ijima (Zool. Anz., 1896, p. 253). Schulze (Rev. Asc. u. Ross., p. 538).

Loc.: Sagami Sea.

29. ***R. dubia*** (F. E. Sch.)

Acanthascus dubius, Schulze (Chall. Rep. Hex., p. 147, pl. LVII 8—13).—*Rossella dubia,* Schulze (Rev. Asc. u. Ross., p. 537).

Loc.: S. of Puerto Bueno, Patagonia.

AULOSACCUS, Ijima.

Autodermalia, stauractins or pentactins. Hypodermalia, only diactins; without pentactins. Gastralia, hexactins. Parenchymal megascleres, only diactins. Intermedia consist of oxyhexasters with tendency to become hemihexactinose or even perfectly hexactinose, and of two kinds of discohexasters (macrodiscohexaster and microdiscohexaster).

30. ***A. schulzei,*** Ijima.

Ijima (Zool. Anz., 1886, p. 252). Schulze (Rev. Asc. u. Ross., p. 543).

Loc.: Sagami Sea.

31. ***A. mitsukurii***, n. sp.

Autodermalia, stauractins with occasional pentactins; rays stout, strongly spiny, 110—176 μ long Gastralia with rays twice or more than twice as long as in autodermalia. Oxyhexaster with diameter of 100—130 μ; occasionally hemi-hexactinose, rarely hexactinose. Macrodiscohexaster spherical, 80—120 μ in diameter; with no less than 5, moderately thick, straight terminals to each very short but thick principal; terminal disc small with minute marginal teeth. Microdiscohexaster of usual shape; diameter 20—23 μ.—Thick-walled, sack-like sponge with prostal needles and hillocky elevations on external side, so that it closely resembles *Acanthascus cactus*.

Loc.: Sagami Sea.

D ACANTHASCINÆ.

Autodermalia variable. Hypodermalia with pentactins or exclusively diactinic Gastralia, hexactins as a rule. Parenchymal megascleres exclusively diactins. Intermedia consist of oxyhexasters and of two kinds of discohexasters, *octasters* and microdiscohexasters.

Key to Genera.

a′. Hypodermal pentactins present.
  b′. Hypodermal pentactin not pronged.............................*Staurocalyptus*.
  b″. Hypodermal pentactin pronged.................................*Rhabdocalyptus*.
a″. Hypodermal pentactin wanting.....................................*Acanthascus*.

STAUROCALYPTUS, Ijima.

Paratangential rays of hypodermal pentactins not armed with hook-like prongs.

Artificial Key to Species.

a′. Autodermalia almost exclusively or predominantly pentactins; at least with a large number of pentactins.
  b′. Octaster with radius of 72 – 145 μ.............................*S. dowlingi*.
  b″. Octaster with radius of 65—85 μ; autodermalia slender-rayed, often stauractins.. *S. roeperi*.
a″. Autodermalia almost exclusively or at least predominantly stauractins.
  b′. Octaster large, usually more than 200 μ in radius...........*S. glaber*.
  b″. Octaster small, not larger than 100 μ in radius.

c'. Autodermalia with occasional pentactins and triactins; rays faintly rough.............. ....*S. heteractinus.*
c''. Autodermalia almost exclusively stauractins, strongly prickly........ ....*S. microchetus.*
a'''. Autodermalia, straight diactins.. ..*S. pleorhaphides.*

32. ***S. dowlingi*** (Lambe).

Rhabdocalyptus dowlingi, Lambe (Trans. Roy. Soc. Canada, Sect. IV, 1893, p. 37, pl. III 2—2h). Schulze (Rev. Asc. u. Ross., p. 554).—*Staurocalyptus dowlingi*, Ijima (Annot. Zool. Jap., vol. I, p. 53).

Loc.: Strait of Georgia, Vancouver Isl.; Sagami Sea.

33. ***S. roeperi*** (F. E. Sch.).

Rhabodocalyptus roeperi, Schulze (Chall. Rep. Hex., p. 158 pl. LXV). (Rev. Asc. u. Ross., p. 553).—*Staurocalyptus roeperi*, Ijima (Annot. Zool. Jap., vol. I, p. 55).

Loc.: S. of Puerto Bueno, Patagonia.

34. ***S. glaber,*** Ijima.

Ijima (Annot. Zool. Jap., vol. I, p. 57).

Loc.: Sagami Sea.

35. ***S. microchetus,*** n. sp.

A rather thin-walled compressed sack of moderately firm texture. Length 95 mm.; breadth 23 mm. by 37 mm.; thickness of wall at middle 3 mm. Afferent apertures small, not over 1 mm. in diameter.—Autodermalia, stauractins with attenuated, strongly prickly rays 85 μ in average length. Hypodermal pentactins small, with paratangential rays only about 1 mm. long; they are protruded out of dermal layer and form a veil at about 1 mm. distance from the surface. Gastralia, hexactins with rays similar to those of autodermalia. Some parenchymal diactins as long as 20 mm. or more. Oxyhexaster 90—106 μ in diameter; rays rather slender, 2—3 and occasionally only 1 terminal to a very short principal. Octasters abundant near gastral surface, 114—136 μ diameter; terminals weakly bent S-like, 7—12 forming an outwardly expanded bunch; principal thick, taking about $^2/_5$ of the length of an entire ray. Microdiscohexasters of usual size and shape exceedingly rare.

Loc.: Sagami Sea.

36. ***S. heteractinus,*** Ijima.

Ijima (Annot. Zool. Jap , vol. I. p. 56).

Loc.: Sagami Sea.

37. ***S. pleorhaphides,*** Ijima.

Ijima (Annot. Zool. Jap., vol. I, p. 58).

Loc.: Sagami Sea.

RHABDOCALYPTUS, F. E. Sch.

Paratangential rays of hypodermal pentactins armed with biserially arranged hook-like prongs.

Artificial Key to Species.

a′. Autodermalia, pentactins and stauractins; octaster 30—40 μ in radius.. *R. dawsoni.*
a″. Autodermalia, predominantly stauractins; octaster 90—120 μ in radius .... *R. victor.*
a‴. Autodermalia, predominantly straight diactins.
  b′. Octaster 65—88 μ in radius.. *R. mollis.*
  b″. Octaster smaller, 38 - 55 μ in radius.............................. *R. capillatus.*

38. ***R. dawsoni*** (Lambe).

Bathydorus dawsoni, Lambe (Trans. Roy. Soc. Canada, Sect. IV, 1892, p. 73, pl. IV 2 and pl. VI 2—2k).—*Rhabodocalyptus dawsoni,* Schulze (Rev. Asc. u. Ross., p. 555).

Loc.: near Vancouver Isl.

39. ***R. victor,*** Ijima.

Ijima (Annot. Zool. Jap., vol. I, p. 52).

Loc.: Sagami Sea.

40. ***R. mollis,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 155, pl. LXVI). (Rev. Asc. u. Ross., p. 552).—Ijima (Annot. Zool. Jap., vol I, p. 50).

Loc.: Sagami Sea.

42. ***R. capillatus,*** Ijima.

Ijima (Annot. Zool. Jap , vol. I, p. 51).

Loc.: Sagami Sea.

ACANTHASCUS, F. E. Sch.

Hypodermal strands consist exclusively of diactins.

42. ***A. cactus,*** F. E. Sch.

Schulze (Chall. Rep. Hex., p. 148, pl. LVII 1—7). (Rev. Asc. u. Ross., p. 551).—Ijima (Annot. Zool. Jap., vol. I, p. 48.

Loc.: Sagami Sea.

43. ***A. alani,*** n. sp.

An ovoid, thick-walled goblet, 190 mm. high; attached by a short stalk-like base. Prostal needles unknown; possibly not present.—Autodermalia exclusively pentactins with rather slender rays, 95—170 μ long Hypodermal strands of indefinite calibre. Gastralia, hexactins, not forming a continuous layer. Oxyhexasters large, with diameter of 144—190 μ; terminals more or less slender, unusually 3—4 to each extremely short knob-like principal; central node spherical. Octasters with radius of 68—110 μ; principal about as long as or longer than terminals, of which 6—8 form an ontwardly expanded tuft. Microdiscohexaster of usual shape and size present in a sparing number.

Loc.: Sagami Sea.

Sci. Coll., May 13th, 1898.

Printed June 10th, 1898.

PRELIMINARY NOTICE OF NEW JAPANESE ECHINOIDS.

By S. YOSHIWARA.
Zool. Inst., Science Coll., Imp. Univ., Tokyo.

Since the publication of my paper on Asthenosoma in Vol. I, Part I of this periodical I have found many new species of echinoids from various parts of Japan. The following contains an account only of their important diagnostic characters. The full paper will be published afterwards, with illustrations.

1. *Cidoris* (*Stereocidaris*) *tenuispinus*, nov. sp.

The general appearance of test and the form of spine at once distinguish this species from other known members of the genus. Test is regularly arched on abactinal side, but actinally it becomes suddenly curved from ambitus, and has a slight concavity near peristome. The color of membrane is dark brown. Basals are almost equal in both height and breadth, radials distinctly excluded from basals. The interambulacrum is three times as wide as the ambulacrum. The scrobicular area is elliptical in form even at ambitus. The miliares in each interambulacral plate are very few. The interporiferous area of ambilacrum carries four regularly arranged vertical rows of tubercles. The primary spines are slender. The fully developed one appears from 3rd or 4th interambulacral plate, so that the whole abactinal side seems to be almost devoid of primary spines. The first is longest having the length of 47 mm. and a uniform breadth of 15 mm., in a specimen having the test of 35 mm. in diameter. All spines are grey and very indistinctly striated on the surface, and some being quite smooth. Those near peristome are flattened, but never crenulated. The miliary spines are very small, with a thick brownish membrane at the base.

Loc.: Sagami Sea.

2. *Cidaris* (*Stereocidaris*) *microtuberculatus*, nov. sp.

This greatly resembles *S. grandis*, Död. But each basal plate has a dis-

tinctly greater width than height. The inner plates of anal system are not very small compared with outer plates; width of interambulacrum generally greater than that of ambulacrum, being 4—5.4 times as measured at ambitus from tests of 25.5—66 mm. in diameters. Ambulacrum very slightly wavy, with very slightly sunken poriferous zone, and never so strongly curved as in *S. grandis*, Död. Interporiferous area tuberculated with two outer and four inner longitudinal rows, the latter carrying very small scaly spines less than one quarter as long as the outer ones. All miliares on the test and abactinal system smaller in size than in *S. grandis*, Död. Neck of primary spine white. Spines near peristome not flattened even in comparatively young specimens (25.5 mm. diam).

Loc.: Sagami Sea.

3. *Cidaris* (*Porocidaris*) *misakiënsis*, nov. sp.

Test more flattened than in *C. elegans*, A. Ag. Covering membrane (especially on abactinal side) and the collar of spine deep brown. Basals not extending to peripheral margin of anal system. Both ambulacral and interambulacral plates at ambitus without any bare median space. There is one vertical row of tubercles between the scrobicular circle and median interambulacral suture. Primary spines white, with a brownish collar 4 mm. high in the longest spine belonging to a test of 39 mm. in diameter, which measured 100 mm. Secondary spines brownish; those on ambulacrum arranged in a single vertical row in each zone.

Loc.: Sagami Sea.

4. *Mespilia levituberculatus*, nov. sp.

Test globular, reddish with yellow or green bare space. Actinal side not so swollen as abactinal side, but not depressed. Primaries and secondaries very small, not perforated or crenulated, thus differing from any other species of *Mespilia*, arranged in each interambulacral zone in two horizontal rows (adoral row having only secondaries) and in five vertical rows at ambitus. Ambulacral pores three in number in each plate, forming two vertical rows. Poriferous zone traversed by two regular or irregular vertical rows of tubercles. On the ambulacrum and interambulacrum there are found bare median spaces crowded with brown pedicellariæ. On the actinal side, however, these bare spaces together with the pedicellariæ are absent. Spines longitudinally striated with orange

stripes, and tipped with white. Near peristome they are flattened.

Beside the above mentioned characters, this species differs from *M. globulus*, A. Ag. in having more tuberculated and higher basal plates, and in median bare space being not so distinctly separated from the portion of tubercles; from *M. Whitmani*, A. Ag. it differs in the height of its test, the number of tubercles at ambulacrum, and the tuberculation of anal plates.

Loc.: Not uncommon in Misaki and Dsushi (Sagami), Kominato (Awa) Gōnoura (Iki).

5. *Salmacopsis pulchellimus*, nov. sp.

Test globular, ambital outline indistinct and circular. The general ground color is green and red, not white and olive brown as in *S. olivacea*, Död. At ambitus each ambulacral plate has arcs of three ambulacral pores, forming two vertical rows, extending to peristomal margin. In each plate of ambulacrum there is one horizontal row of alternating primary and secondary tubercles composed of three of the former and a few of the latter, and another horizontal row lying on the upper side, composed of a small number of small secondaries, but the part lying below the first mentioned horizontal row is entirely destitute of tubercles. Surface of both interambulacral and ambulacral plates not smooth, and the furrows converge from each pit to median primary tubercles. Tubercles smooth, not crenulated. Spines longest at ambitus (5 mm. in a test of 21 mm. in diameter), greenish, tipped and banded with light red color.

Loc.: Tomo (Bingo).

6. *Echinostrephus pentagonus*, nov. sp.

This species resembles greatly *E. molare*, A. Ag., but on examining many specimens with the diameter varying between 19.5 mm. and 28 mm. I find the following important differences which justify us in making a new species.

1. The anal system is covered with many miliares of very small plates.
2. There are only three pairs of ambulacral pores in each arc.
3. The whole abactinal system is naked, except the radials which have only two secondaries on each plate.
4. The outline is distinctly pentagonal.

Loc.: Bonin Islands.

7. *Echinus multicolor*, nov. sp.

Test variegated. First in interambulacrum there appears a greenish color which becomes suddenly brown at ambitus; interporiferous area white on abactinal side, but actinally banded with three or four broad brownish bands, leaving narrow white spaces between. Anal plates not provided with tubercles. Two or three small tubercles distributed on each plate of abactinal system. Interambulacral plate at ambitus with four tubercles; ambulacral plate with one primary tubercle, and another smaller one which is present only on the inner side. Poriferous zone with an irregular row of pores, three pairs forming an arc, without any tubercle between each pore. Spines longitudinally striated, tipped with two or three violet stripes, longest one measuring 3 mm. in a test of 14 mm. in diameter.

Number of coronal plate (which is 16), arrangement of ambulacral pores, other structures of test, and the color of spine distinguish this species from all known members of the genus.

Loc.: Akune (Satsuma).

8. *Fibularia acuta*, nov. sp.

The general outline is like that of a hen's egg, pointed anteriorly, and broad posteriorly. The height is not uniform; the anterior part being higher than the posterior and making the wall of actinostome very convex. Apical system lies on the anterior side of test. Anus elliptical, equal in size with or larger than the length of mouth (that is ⅓ the radius) and separated from the mouth by about ⅓ the length of the radius. Ambulacral pores extending for 3 mm. in a test 10 mm. long and 6.5 mm. broad, and reaching outwards more than ½ the radius, and diverging greatly. On actinal side there are scattered tentacles coming out from single pores. The tubercles are not closely distributed on the actinal side as in *F. volva*, Agass. The ridges are very slightly visible actinally and this only at the median ambulacral and interambulacral lines. There are no prominent miliares near actinostome as in *F. volva*, Ag., and *F. australis*, Desm.

Loc.: Misaki (Sagami), Shigajima (Chikuzen).

9. *Plesianthus ogasawaraënsis*, nov. sp.

Test elliptical, with a slightly undulating ambitus, differing from *P. excelsior*,

Död. The test (74 mm. by 86 mm.) is widest not only on the side opposite the anterior extremity of the rosette, but also in the line drawn through its posterior extremity. Actinal surface concave, not flattened as in *P. excelsior*, Död. Suture between interambulacral and ambulacral plates distinctly recognizable from external surface, while that of *P. japonicus*, Död. is entirely invisible from outside. General ground color grey, poriferous zone reddish. Ambulacral furrow reaches the ambitus, but very indistinct in *P. clypeus*, Död. Spine with red stripes, thus differing from *P. japonicus*, Död. Tubercles fewer than in the last mentioned species. *P. subdepressus*, Gray differs from the present species in having the greatest width at the posterior part, in the test rising suddenly at the extremities of ambulacral petals, in the lanceolate form of the petals, and the yellowish-green ground color with deep carmin colored poriferous zones; *P. humilis*, Leske differs in having the uniform breadth of periostome; *P. rotundis*, A. Ag. differs in having a rather circular outline, spindle shaped ambulacral rosette and the greatest width near centre. It is needless to give the distinction between this and the remaining species.

Loc.: Bonin Islands.

10. *Echinarachnis tenuis*, nov. sp.

Ground color white to light violet. Outline pentagonal, with a strongly wavy contour. Anus lying on the abactinal side; the part of the test where it lies not pointed. Test extremely thin. Ambulacral rosette extending half the radius and widely open. Ambulacral furrow almost unrecognizable. Suture between each two plates visible from surface. Primary and secondary spines have the greatest thickness of membrane. Diameter of the largest specimen 30 mm.

Loc.: Kominato (Awa).

Printed June 10th, 1898.

MISCELLANEOUS NOTES.

On the Appearance of the Grey Phalarope in Uraga Channel. —According to SEEBOHM the Grey Phalarope (*P. fulicarius*) is a winter visitor to the Kurile Islands " but it has not yet been recorded from Japan proper."

On the 27th Nov. '94 Mr. J. C. HAITLAND of Yokohama obtained one specimen in that neighborhood, and I have no record of any other examples taken in Japan proper until the occurrence referred to below.

On the 8th of this month (April) the Yacht " Golden Hind " left Uraga for Ukishima to see if possibly the Swifts (*C. pacificus*) had arrived at their breeding place there. However we did not see any, and as a hard and cold north wind was blowing we made for Misaki. On the way we saw several flocks of small birds which we took to be Turustones (*S. interpres*).

Next day we sailed down to the Doketsuba off Sunosaki, and we found the sea swarming with these same small birds, which on shooting we found to be Grey Phalaropes. Some were white on the lower parts, others in their breeding plumage or partly so. The numbers seen can only be described as *myriads*. They were in flocks of four or five to a couple of hundred in every direction either flying about or sitting on the surface of the water busily feeding. The weather was cloudy and many other birds were about. Albatross, Shearwater, Gannet, Auks, Cormorants, and Divers (*C. arcticus ?*)—these latter were particularly numerous.

On the night of the 9th it rained heavily, and next morning a strong southerly gale came up. By noon the wind decreased somewhat and at 2 o'clock " Gold Hind " left Misaki for Yokohama. When rounding Tsurugisaki a tremendous sea was running but the Phalaropes were still about in smaller numbers. They were sitting on the sea but had to fly up whenever a huge comber threatened to come tumbling down on them. Inside Tokyo Bay we found it calm and near Futsusaki there were a great many more of these Phalaropes.

I may add that the Misaki fisherman KUMAKICHI was with us and he said he had never seen these birds before. As fishermen are so accustomed to watch the birds for indications as to the whereabouts of the fish it is not likely that he would have failed to notice the Phalarope on a previous occasion, which tends to show that the present occurrence is exceptional.

ALAN OWSTON.

Zoological Society of Tokyo.—The monthly meetings of the Society for October—March were held in the lecture room of the Zoological Institute of the Imperial University. The following papers were read:

October 16.—Prof. IWAKAWA on the "Fresh-water and Land Mollusca of South-Central Japan." He pointed out the difference of the prevailing forms of this part and those of the northern part with reference to the fresh-water forms. Thus, *Paludina oxytropis*, the common form in the north, does not occur in the south-central part, while *Pal. ingallsiana*, the prevailing form of the latter is not found in the north; so also, the genus *Dipsas* which is very common in the north is rather uncommon in south-central Japan, where it is mostly replaced by *Anodonta*.

November 20.—Prof. ISHIKAWA on the "Spawning and Larva of Megalbatrachus Sieboldii."

December 18.—Mr. YOSHIWARA on "Japanese Echinoidea."

January 29.—Mr. TATA reported on his collecting tour in Formosa.

Mr. AIDA on the "Fauna of the Western Coast of Izu."

February 19.—Mr. YOSHIWARA on "a Fossil Astriclypeus from Kōshū."

Mr. IIZUKA on "the Annelids of the Northern Shore of the Bay of Suruga."

March 19.—Mr. MIYAJIMA on "Veretillum floridum, n. sp."

Mr. AIDA on the "Structure and Habit of the Manis from Formosa."

NEW OR IMPERFECTLY KNOWN SPECIES OF EARTHWORMS. NO. 1.

By SEITARO GOTO, Professor, and SHINKICHI HATAI, Assistant.
First High School Tokyo.

In this series of papers we purpose to describe new or imperfectly known species of earthworms collected from various parts of the Japanese Empire; and at the outset we wish to state clearly the respective part which each of us has taken in the work. For the practical portion of the work as well as the determination of new species the credit is entirely due to the junior writer (H), while for a general supervision of the work and the form in which the results are presented the senior writer is alone responsible. The species will be described without any definite order, as their study is completed. In the present paper we have put together only the species of the genus *Perichæta* that have come into our hands.

The following characters, which are, unless otherwise stated, common to all, have been omitted in the following descriptions: (1) Gizzard in VIII—IX; (2) ovaries in XIII, oviduct pore in XIV; (3) spermduct pores in XVIII.

1. ? *Perichæta Sieboldii*, Horst.

We mention this species, the oldest known to science from Japan, with a query, because, strange to say, we have not yet come across any specimen exactly answering to its descriptions given by European writers They all agree in stating that the spermathecæ are situated in VI/VII, VII/VIII, and VIII/IX, and the number of setæ between the male genital pores are given as 13,* while for the spermathecal region it is given as 76 by ROSA and 80 by HORST.† Now the numerous specimens which we regard as belonging to *P. Sieboldii* all present this difference that, the spermathecæ lie in V/VI,

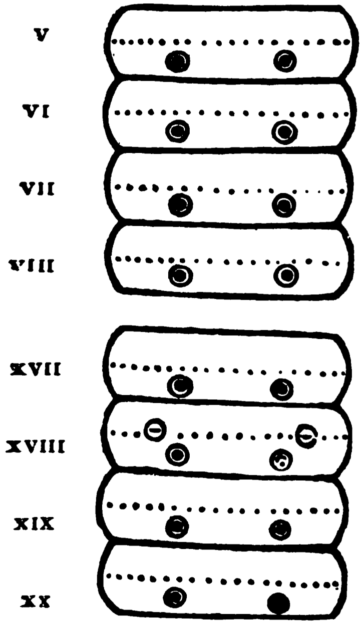
* ROSA, D.—Die exotischen Terricolen des K. K. naturhistorischen Hofmuseums (Wien), 1891, p. 401; "Die männlichen Geschlechtsöffnungen am 18. Segment liegen in der 14. Borstenlinie."

† We have not been able to gain access to HORST's original description, and have therefore relied on references by later writers.

VI/VII, and VII/VIII, therefore one segment anteriorly than is stated to be the case by previous writers, while the number of setæ lying between the male pores we have observed to be 14-19, and the same in the spermathecal region to be about 60. The last two points cannot, in our opinion, be regarded as of much systematic importance, as we have learnt from our experience, that they are rather freqnently subject to variation. It must sound presumptuous in us to suppose that all the previous observers have fallen into the same error; but it must at the same time be admitted as a strange circumstance that we have never met with any specimen answering to the description ot previous writers, although we have made a rather extensive collection in the same locality whence the specimens of the European writers are known to have come or have presumably been collected. On the cohtrary there have come under our obs rvation at least more than two hundred specimens differing from *P. Sieboldii* in a single character of systematic importance, viz. the position of the spermathecæ mentioned above. These worms are very common in this part throughout the warmer months of the year, and the are widely distributed, since we have specimens also from Sendai, Shizuoka, and Tsugaru. They are therefore the most likely to be represented in any chance collection of earthworms from this part of Japan; and we know that *P. Sieboldii* is represented in all the European collections of earthworms made in Japan, of which we have record (Leyden, Vienna, Oxford, Berlin). It would be preposterous to suppose that all the specimens in Europe presented precisely the same variation. We therefore await the result of a renewed examination on the part of European students.

2. *Perichæta fuscata*, n. sp.

Length of body 150 mm., breadth 5 mm.; number of segments 110; dusky colored on the back, lighter colored on the ventrum. Clitellum XIV—XVI, without setæ. Towards the two extremities of the body the boundary lines between the segments are very distinct and the setæ are longer; number of setæ smaller in the anterior segments, being 24-25 in the spermathecal segments and about 35 in the more posterior segments. First dorsal pore XIII/XIV: spermathecal openings four pairs, V/VI, VI/VII, VII/VIII, VIII/IX; V, VI, VII, VIII with a pair of genital papillæ behind the chætal line; oviduct pore single; male openings on the top of papillæ; XVII, XVIII, XIX, XX with a dair of genital papillæ situated inside the line of the male pores and behind the

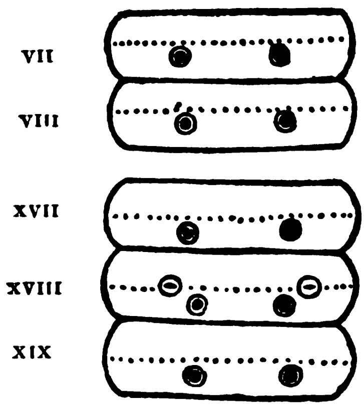


chætal line; male pores separated by 9 setæ.

Intestine begins in XV; *intestinal cœca one pair in XXVII;* thickened septa V/VI—VII/VIII in front of the gizzard, and X/XI—XIII/XIV behind it, septum IX/X very thin and transparent, septum VIII/IX absent. Spermathecæ four pairs, in VI, VII, VIII, IX, with diverticula longer than the sac and enlarged at the blind end. Testes in X, XI; sperm reservoir in XI, XII; ovary small, close to the ventral body wall. Ovisacs (*receptaculum ovorum*) two pairs, in XIII, XIV, with the proximal portion attached to the septa between these segments and the next preceding. Prostate gland small, and only slightly lobulated. Last heart in XIII.

Loc.—Kamakura.

3. *P. campestris*, n. sp.



Length of body 120 mm., breadth 6 mm., number of segments 77. Clitellum XIV—XVI, without setæ. Number of setæ in the spermathecal segments 35, but in XVIII there are 47; generally speaking there are fewer setæ in the more anterior segments. First dorsal pore XIII/XIV. Spermathecal pores two pairs in VII/VIII, VIII/IX; VII, VIII with a pair of genital papillæ lying close to the spermathecal pores and behind the chætal line. Oviduct pore single. Sperm duct openings on papillæ, separated by 7 setæ; XVII, XVIII, XIX with a pair of genital papillæ behind the chætal line.

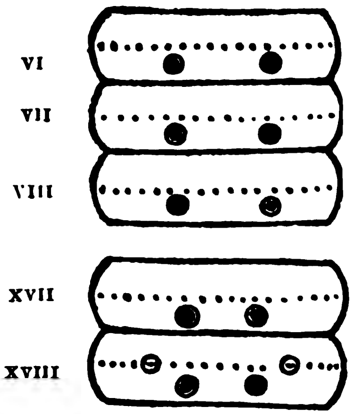
Intestine begins in XV; intestinal cœca one pair, in XXVI, large, extend-

ing for 4 segments anteriorly, and with the anterior end usually winding. Thickened septa V/VI—VII/VIII in front of the gizzard, and X/XI—XIII/XIV behind it; septa VIII/IX, IX/X wanting. Spermathecæ two pairs, in VIII, IX, with small diverticula, blind end enlarged. Testes in X, XI; sperm reservoirs in XI, XII. Ovisacs two pairs in XIII, XIV, small. Prostate gland lobate, occupying XVII—XX. Last heart in XIII.

Loc.—Kamakura.

4. *P. kamakurensis*, n. sp.

Length of body 120 mm., breadth 6 mm., number of segments 79. Clitellum XIV—XVI, without setæ. Number of setæ in the spermathecal segments about 33. First dorsal pore XII/XIII. Spermathecal pores three pairs in V/VI, VI/VII, VII/VIII; VI, VII, VIII with a pair of genital papillæ behind the chætal line. Oviduct pore single. Sperm ducts opening on papillæ, the pores being separated by 10 setæ; one pair of genital papillæ on the same and the preceding segments behind the chætal line and inside the male pores.



Intestine begins in XIV; one pair of intestinal cæca in XXVII, extending for three segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XII/XIII; no septa in VIII/IX, IX/X. Spermathecæ three pairs, in VI, VII, VIII, with diverticula. Testes in X, XI; sperm reservoirs in XI, XII, with the dorsal surface lobed. Ovary small; ovisacs in XIII. Prostate gland somewhat rectangular, with shallow furrows on the surface, small, extending through XVII, XVIII; sperm duct without any terminal bulb. Last heart in XIII.

Loc.—Kamakura, Tokyo.

5. *P. parvula*, n. sp.

Length 32 mm., breadth 2 mm., number of segments 48. Clitellum XIV—XVI, without setæ. First dorsal pore XI/XII. Spermathecal pores three pairs, in V/VI, VI/VII, VII/VIII; no genital papilla in this region. Sperm

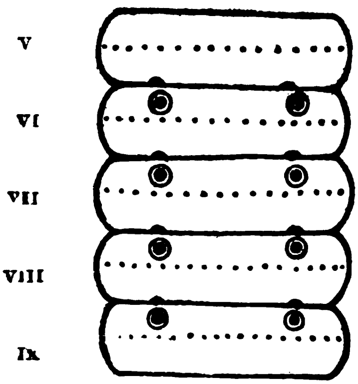
duct pores could not be observed; no genital papilla around them. Color of alcoholic specimens dusky.

Intestine begins in XVI; one pair of intestinal cœca in XXVIII, elongated, extending through four segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XV/XVI; septa VIII/IX, IX/X wanting. Spermathecæ three pairs, in VI, VII, VIII, without diverticula. Testes in X, XI; sperm reservoirs in XI. XII. Ovary comparatively large; ovisac absent. Prostate gland wanting. Last heart in XIII.

Loc.—Kamakura.

6. *P. heteropoda*, n. sp.

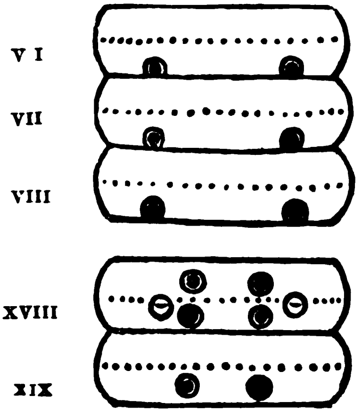
Length 100 mm., breadth 4 mm., number of segments 72; all the segments except the first and the last of the same breadth. Color brown, except the clitellum, which is yellowish. Clitellum XIV—XVI, without setæ. *Setæ of segments II—XIII thicker and longer;* their number in the spermathecal segments 32. First dorsal pore X/XI Spermathecal pores four pairs, in V/VI, VI/VII, VII/VIII, VIII/IX; VI, VII, VIII, IX, with a pair of genital papillæ *in front of the chætal line.* Sperm duct pores separated by 12 setæ; no genital papillæ in this region; margin of the pores slightly elevated.



Intestine begins in XVII; one pair of intestinal cœca in XXVI, extending for three segments anteriorly. Thickened septa V/VI—VII/VIII and *X/XI—XV/XVI;* septa VIII/IX, IX/X wanting. Spermathecæ 4 pairs, in VI, VII, VIII, IX, with diverticula which are not convoluted but with the blind end simply enlarged. Testes in X, XI; sperm reservoirs in XI, XII. Ovary large; ovisac absent; oviduct also large and very easy to observe. The two vasa efferentia unite near the septum XII/X II; *prostate gland absent; terminal bulb present,* situated a little in front of the external male pore. Last heart in XIII.

Loc.—Tokyo, Tokorosawa (about 20 miles N.W. from Tokyo), Kamakura.

7. *P obscura*, n. sp.



Length 80 mm., breadth 4 mm., number of segments 76. Clitellum XIV—XVI, without setæ, not glandular and with the same appearance as the other segments; *each clitellar segment with a transverse granulated ridge on the ventral side.* Number of setæ in the spermathecal segments 35—38. First dorsal pore X/XI. Spermathecal pores 3 pairs, in VI/VII, VII/VIII, VIII/IX, on top of papillæ directly in front of the intersegmental line.* Sperm duct pores separated by 14 setæ; segment XVIII with two pairs of genital papillæ, one in front of chætal line and the other behind it; segment XIX with one pair of similar papillæ behind the chætal line.

Intestine begins in XV; one pair of intestinal cœca in XXVI, very small, extending for 2 segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XIV/XV; septa VIII/IX, IX/X wanting. Spermathecæ 3 pairs, in VII, VIII, IX, with diverticula, finger shaped and straight. Testes in X, XI; sperm reservoirs in XI, XII. *No ovisac.* Prostate gland small, extending through only 2 segments, lobed, rectangular; no terminal bulb on the sperm duct. Last heart in XIII.

Loc.—Kamakura.

8. *P. scholastica*, n. sp.

Length 155 mm., breadth 5 mm., number of segments 127. Clitellum XIV—XVI, without setæ. Number of setæ in the spermathecal segments 39—48, posterior to IX 48 in each; in preclitellar segments the ventral setæ are larger than the dorsal, but in postclitellar segments they are all of the same size; in the nine segments immediately in front of the clitellum as well as in

* In the upper portion of the accompanying cut the spermathecal openings have by oversight been represented like genital papillæ.

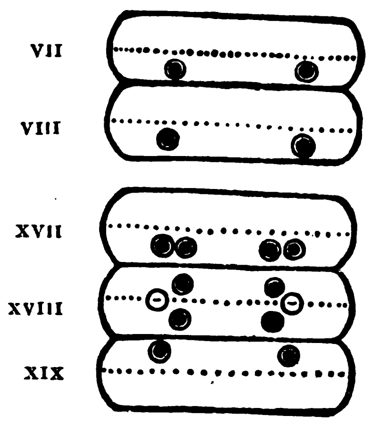
6—7 segments immediately behind it the chætal lines are more prominent and the intersegmental lines more distinct. Color of clitellum in alcoholic specimens brown, the rest grey Spermathecal pores 4 pairs, in IV/V, V/VI, VI/VII, VII/VIII; no genital papillæ in this region. Sperm duct pores separated by 8 setæ; genital papillæ wanting.

Intestine begins in XV; one pair of intestinal cœca in XXV, extending forwards as far as XXIII. Thickened septa VI/VII, VII/VIII and X/XI—XIV/XV; septa V/VI, VIII/IX, IX/X absent. Spermathecæ 4 pairs, in V, VI, VII, VIII. In the single specimen of this species that has come under our observation only the spermatheca on the left side of VII was provided with a minute diverticulum; which is probably a departure from the rule. Testes in X, XI; sperm reservoirs in XI, XII. Ovisacs two pairs, in XIII, XIV, very small. Prostate gland large, 2-lobed, *directly opening into the sperm duct without the mediation of a duct.* Last heart in XIII.

Loc.—Tokyo.

9. *P. decimpapillata*, n. sp.

Length 150 mm., breadth 4 mm., number of segments 115, of uniform breadth throughout. Clitellum XIV—XVI, without setæ. Number of setæ in the spermathecal segments 36. First dorsal pore XI/XII. Spermathecal pores 3 pairs, in V/VI, VI/VII, VII/VIII; VII, VIII with a pair of genital papillæ behind the chætal line. Sperm duct pores on papillæ, separated by 10 setæ; five pairs of genital papillæ in the vicinity, two pairs in XVII behind the chætal line, two pairs in XVIII inside the male pores, one in front of, and the other behind, chætal line, and one pair in XIX in front of the chætal line, those in XVIII being in a line with the inner pair of the preceding segment.



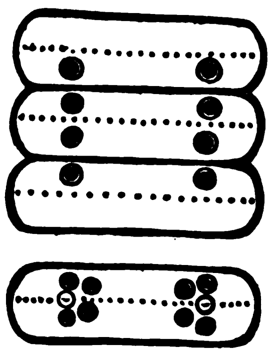
Intestine begins in XV; one pair of intestinal cœca in XXVI, extending for three segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XIII/XIV; septa VIII/IX, IX/X absent. Spermatheca 3 pairs, in VI, VII, VIII, *with very small diverticula.*

Testes in X, XI; sperm reservoirs in XI, XII. Ovisacs one pair, in XIII. Prostate gland large, extending through 5 segments, XVI—XX, lobate. No terminal bulb on the sperm duct.

Loc.—Tokyo.

10. *P. flavescens*, n. sp.

Length 120 mm., breadth 6 mm., number of segments 126. Clitellum XIV—XVI, swollen, without setæ. Anal segment comparatively long Number of setæ in the spermathecal segments constant, viz. 20; these as well as the anterior segments with larger but fewer setæ than the posterior segments, which are provided with more but smaller setæ, there being 40—50 in each. First dorsal pore in XIII/XIV. Spermathecal pores 3 pairs, in VI/VII, VII/VIII, VIII/IX; VII with one pair of genital papillæ behind the chætal line, VIII with two pairs, one in front of, and the other behind, the chætal line, IX with one pair in front of the chætal line; there being 4 pairs in all in this region. Sperm duct pores on top of papillæ, separated by 7 setæ; 4 pairs of genital papillæ in XVIII, two external and two internal; the internal pairs lying inside the male pores, close to the chætal line, one in front of, and the other behind it; the external pairs are also situated in front and behind, but lie slightly external to the male pores; the papillæ around each male pore occupying the four corners of a trapezoid with the parallel sides parallel to the long axis of the worm and the shorter side turned inward.

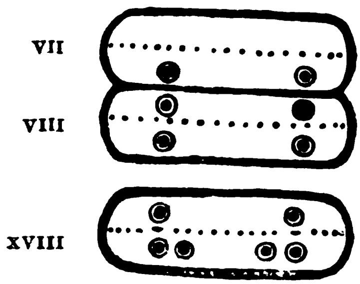


Intestine begins in XV; one pair of intestinal cœca in XXV, extending for three segments anteriorly. Thickened septa IV/V—VII/VIII and X/XI—XII/XIII; septa VIII/IX, IX/X wanting. Spermathecæ 3 pairs, in VII, VIII, IX, with large vesicular portions and short ducts; only the pair in VIII with minute diverticula. Testes in X, XI; sperm reservoirs in XI, XII. Ovisacs in XIII. Prostate gland large, occupying XVII—XIX, 2-lobed,

with shallow furrows on the surface. No terminal sac on the sperm duct. Last heart in XIII.

Loc.—Tokyo.

11. *P. producta*, n. sp.



Length 140 mm., breadth 6 mm, number of segments 120. Clitellum XIV—XVI, without setæ. Number of setæ in VI 30, in VII 35, in VIII 39, in IX 31, in the more posterior segments 40—45; preclitellar setæ large. First dorsal pore in XIII/XIV. Spermathecal pores 3 pairs, in VI/VII, VII/VIII, VIII/IX; genital papillæ three pairs, one pair in VII behind the chætal line, two pairs in VIII, one in front of, the other behind, the chætal line. Sperm duct pores slit-shaped and not opening on papillæ, therefore difficult to make out, separated by 8 setæ; genital papillæ 3 pairs in XVIII, one pair in front of the chætal line, in a line with the male pores, and two pairs, internal and external, behind the chætal line, the external pair being in a line with the male pores.

Intestine begins in XV; one pair of intestinal cœca in XXV, extending for three segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XIII/XIV; septa VIII/IX, IX/X absent. Spermathecæ 3 pairs, in VII, VIII, IX, with large vesicular portions and short ducts, without diverticula. Testes in X, XI; sperm reservoirs in XI, XII. Ovaries comparatively large; ovisacs small, in XIII, XIV. Prostate gland wanting; no terminal bulb on the sperm duct. Last heart in XIII.

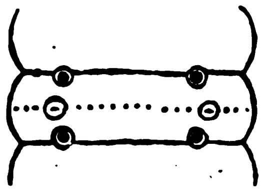
Loc.—Tokyo.

As cases of variation occurring in this species we may mention four specimens which differed from the above in the following respects: (1) clitellar segments with about 40 setæ, (2) number of setæ in the spermathecal segments 45, in III 30, in XX 48, (3) setæ small and of uniform size everywhere, (4) sperm duct pores on top of papillæ, and separated by 10 setæ. We think that these differences are hardly entitled to specific distinction.

12. *P. micronaria*, n. sp.

Length 66 mm., breadth 3 mm, number of segments 106. Clitellum XIV—XVI, without setæ. Number of setæ in the spermathecal segments 28-32, more posteriorly 35. First dorsal pore in XI/XII. Spermathecal pores 4 pairs in V/VI—VIII/IX; *no genital papillæ in this region.* Sperm duct pores large, on top of papillæ, separated by 8 setæ; two pairs of genital papillæ in XVIII just inside the lines of the male pores, each pair close to the intersegmental lines.

XVIII



Intestine begins in XV; one pair of intestinal cœca in XXVI, extending for two segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XII/XIII. Spermathecæ 4 pairs, in VI—IX; only the pair in VIII with minute diverticula. *No ovisac.* Prostate gland in XVII—XX. Testes in X, XI; sperm reservoirs in XI, XII, comparatively small. Last heart in XIII.

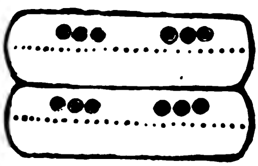
Loc.—Tokyo.

13. *P. vittata*, n. sp.

Length 100 mm., breadth 6 mm., number of segments 68. In the dorsal aspect, the chætal lines are light grey and the rest dark brown, thus appearing banded; in the ventral view of uniform light grey. Clitellum flesh-red, XIV—XVI, without setæ. Number of setæ in III 35, in VII 57, in VIII 59, in XVIII 60. First dorsal pore in XIII/XIV. Spermathecal pores 6 *pairs, on top of papillæ,* 3 *pairs in both VII and VIII, those of the same segment being situated in the same transverse line and in front of the chætal line.** Sperm duct pores could not be detected externally.

VII

VIII



Intestine begins in XVI; one pair of intestinal cœca in XXVI, *with five secondary cœca,* of which the most dorsal is longest and the more ventral ones gra-

* The punctated circles in the accompanying cut represent the spermathecal openings and not genital papillæ, as might be inferred from analogy with other cuts.

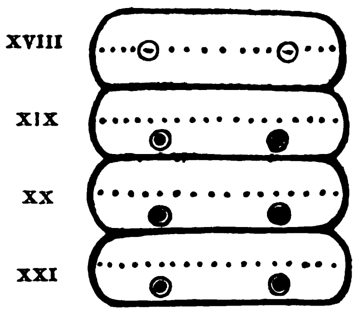
dually become shorter. Thickened septa V/VI—VII/VIII and X/XI—XV/XVI. Spermathecæ 6 pairs, three in VII and three in VIII, without diverticula. Testes in X, XI; sperm reservoirs in XI, XII, very small, only the dorsal edges projecting on either side of the intestine. Ovaries as well as ovisacs comparatively large, in XIII. The two vasa efferentia unite in XII; the vas deferens can be traced sometimes as far back as XVIII or more backwards, the extremity being usually club-shaped. Last heart in XIII.

Loc.—Tokyo, Kamakura.

Among the numerous specimens of this species that have come under our observation two presented the following points of variation: (1) first dorsal pore in XII/XIII, (2) spermathecæ only in VIII, and the pores neither on top of papillæ nor *in* the segment but in the intersegmental line between VII and VIII.

14. *P. grossa*, n. sp.

Length 240 mm., breadth 8 mm., number of segments 141. Near the two ends of the body the chætal lines are more prominent and the intersegmental lines more distinct. Clitellum XIV—XVI, without setæ. Number of setæ in the spermathecal segments 53-57, in the more posterior segments 60-70. First dorsal pore in XIII/-XIV. Spermathecal pores 4 pairs, in V/VI-VIII/IX; no genital papillæ around them. Sperm duct pores on top of papillæ, separated by 9 setæ; XIX, XX, XXI each with a pair of genital papillæ behind the chætal line.



Intestine begins in XV; one pair of intestinal cœca in XXVI, very long, extending for 6 segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XIV/XV; septa VIII/IX, IX/X wanting. Spermathecæ 4 pairs, in VI, VII, VIII, IX, with tubular, convoluted diverticula longer than the pouches. Testes in X, XI; sperm reservoirs in XI, XII; both testes and the reservoirs large. Ovary large; no ovisac. Prostate gland lobate, in XV—XIX. Last heart in XIII.

Loc.—Kawaguchi (Prov. Kai).

15. *P. schizopora*, n. sp.

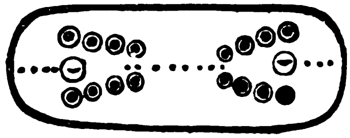
Length 78 mm, breadth 4 mm., number of segments 96. Clitellum XIV—XVI, without setæ, but with distinct intersegmental lines and with the same color as the rest of the body. Setæ fewer in the anterior segments, 33 in III, 44 in IV, 53 in V, and thereabout in the more posterior segments. First dorsal pore in XII/XIII. Spermathecal pores one pair, in VII/VIII, distinct and slit like, with a slightly elevated margin. *Oviduct pores one pair*, the two being separated by about 1 mm. Sperm duct pores could not be observed. No genital papilla anywhere.

Intestine begins in XV ; 5 pairs of intestinal cœca in XXVI, the most dorsal pair being longest, and thence decreasing towards the ventrum. Thickened septa V/VI—VI/VII and X/XI—XIV/XV ; in VII/VIII there are a few oblique muscles but no distinct septum ; septa VIII/IX, IX/X absent. Spermathecæ one pair, in VIII. In the single specimen observed, the spermatheca of the left side had *three diverticula*, two of which were shorter than the pouch and had vesicular extremities, while the third was long and finger-shaped ; the spermatheca of the right side had only one finger-shaped diverticulum ; that of the left side probably represents the normal condition. Tests in X, XI ; sperm reservoirs in XI, XII, very small. Ovisacs in XIII. No special feature about the oviducts except that *they are entirely separate.* No prostate gland ; the sperm duct can be traced only as far as XIV. Last heart in XIII.

Loc.—Tokyo.

16. *P. Takatorii*, n. sp.*

XVIII



Length 314 mm., breadth 8 mm., number of segments 120. Ventral and dorsal sides very different in color, the former being yellowish brown and the latter light grey. Clitellum XIV—XVI, without setæ, of

---

* Dedicated to Mr. Y. Takatori of the Agricultural Department of the Government of Formosa, whose kindness in complying with our request to collect and send earthworms is here gratefully acknowledged. We owe this as well as the next following species to him.

uniform light yellow. Number of setæ fewer in the anterior segments; in the spermathecal segments 51, behind them about 65. First dorsal pore in XI/XII. Spermathecal pores two pairs, in VII/VIII, VIII/IX; with two or three genital papillæ on the posterior margin of the next preceding segment. Sperm duct pores on top of papillæ, each surrounded by 8 genital papillæ arranged by fours on the two sides of an isosceles triangle with the base turned externally.

Intestine begins in XV; one pair of intestinal cœca in XXVI, extending for 3 segments anteriorly. Thickened septa V/VI—VII/VIII and X/XI—XIII/XIV; septa VIII/IX, IX/X wanting. One pair of spermathecæ in VIII, with two finger-shaped, more or less winding diverticula of unequal lengths, and another pair of similar spermathecæ and three pairs of small accessory spermathecæ without diverticula in IX; the accessory spermathecæ being situated internally to the well-developed ones. Testes in X, XI; sperm reservoirs in XI, XII. Ovisacs in XIII. Prostate glands lobate, in XVII—XXI. Last heart in XIII.

Loc.—Taipei-fu (Northern Formosa).

17. *P. candida,* n. sp.

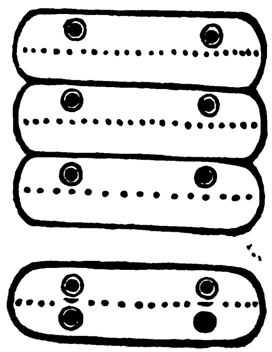
Length 150 mm., breadth 6 mm., number of segments 95. Color dark brown on the dorsal side, light grey on the ventral side, and the two colors meeting in a line on the lateral side; with metallic lustre; chætal lines faintly white. Clitellum XIV—XVI, without setæ. Setæ somewhat widely separated from each other; in II there were 20 setæ, in III 32, in IV 34, in VII 44, in VIII 46, in XVIII 44. First dorsal pore in XIII/XIV. Spermathecal pores two pairs, in VI/VII, VII/VIII; one pair of genital papillæ in front of the chætal line in VI, VII, VIII. Sperm duct pores separated by 12 setæ; two pairs of genital papillæ directly inside the male pores, one on either side of the chætal line.

VI

VII

VIII

XVIII



Gizzard in IX—X; intestine begins in XV; one pair of intestinal cœca in XXVII, extending for two segments anteriorly. Thickened septa VI/VII—

VIII/IX and X/XI—XIII/XIV ; septa IX/X, X/XI wanting. Spermathecæ two pairs, in VII, VIII, with diverticula more than 3 times as long as the pouches. Testes in X, XI ; sperm reservoirs in XI, XII. No ovisac. Prostate gland large, lobate, in XVII—XXII ; terminal portion of the sperm duct S-shaped. Last heart in XIII.

Loc.—Taipei-fu (Northern Formosa).

The principal characters of the species here described are summarised in the adjoined table.

Printed September 30th, 1898.

ɩpillæ.
[, XVII, XIX.
XVIII,XI
VIII. ⟨VIII.
'III, IX.
, XIX.
I, XVII, ., XIX
IX, XVII
[I, XVIII.
I, XIX.
0
⟨X. XXI.
0
VIII.
VIII, XVI

...mathecæ.	Ist. dorsal pore.	Last heart.	Recept. ovorum.	Prostate.	Termin. sac.	Gizzard.	Commenc intestine.	intestinal cœca.	Thickened septa.
·I VII.	XIII/XIV.	XIII.	XIII, XIV.	XVIII.	0	VIII–IX.	XV.	XXVII.	V/VI–VII/VIII. X/XI–XII/XIII.
·II, VIII.	XII/XIII.	XIII.	XIII, XIV.	XVIII.	0	VIII–IX.	XV.	XXVI.	V/VI–VII/VIII, X/XI–XIII/XIV.
·II, VIII.	XII/XIII.	XIII.	XIII.	XVIII.	0	VIII–IX.	XIV.	XXVII.	V/VI–VII/VIII X/XI–XII/XIII.
II, VIII.	XI/XII	XIII.	0	0	0	VIII–IX	XV.	XXVIII.	V/VI–VII/VIII, X/XI–XV/XVI.
·II, VIII, IX.	X/XI.	XIII	0	XVIII.	Present	VIII–IX.	XVII.	XXVI.	V/VI–VII/VIII, X/XI–XV/XVI.
VIII, IX.	X/XI.	XIII.	0	XVIII.	0	VIII–IX	XV.	XXVI	V/VI–VII/VIII, X/XI–XV/XVI.
I, VII, ·III.	XIII/XIV.	XIII.	XIII, XIV.	XVIII	0	VIII–IX.	XV.	XXV.	VI/VII–VII/VIII, X/XI–XIV/XV.
·II, VIII.	XI/XII.	XIII.	XIII.	XVIII	0	VIII–IX.	XV.	XXVI	V/VI–VII/VIII, X/XI–XIII/XIV.
VIII, IX.	XIII/XIV.	XIII.	XIII.	XVIII.	0	VIII–IX.	XV.	XXV.	IV/V–VII/VIII, X/XI–XII/XIII.
VIII, IX.	XIII/XIV.	XIII.	XIII, XIV.	0	0	VIII–IX	XV.	XXV.	V/VI–VII/VIII, X/XI–XIII/XIV.
·II, VIII, IX.	XI/XII.	XIII.	0	XVIII.	0	VIII–IX	XV.	XXVI.	V/VI–VII/VIII, X/XI–XII/XIII.
I, VIII.	XIII/XIV.	XIII.	XIII.	0	0	VIII–IX	XVI.	XXVI.	V/VI–VII/VIII, X/XI–XII/XIII.
·II, VIII, IX.	XIII/XIV.	XIII.	0	XVIII.	0	VIII–IX	XV	XXVI.	V/VI–VII/VIII, X/XI–XIV/XV.
VIII.	XII/XIII.	XIII.	XIII.	0	0	VIII–IX.	XV.	XXVI	V/VI–VI/VII, X/XI–XIV/XV.
III, IX.	XI/XII.	XIII.	XIII.	XVIII.	0	VIII–IX.	XV	XXVI.	V/VI–VII/VIII. X/XI–XIII/XIV.
I, VIII.	XIII/XIV.	XIII	0	XVIII.	0	IX–X.	XV.	XXVII.	VI/VII–VIII/IX, X/XI–XIII/XIV.

	Length mm.	Breadth mm.	No. of segments.	Setæ in spermath segment.	Setæ between male pores.	Clitelium.	Genital papillæ.
P. fuscata.	150	5	110	24—35	9	XIV—XVI.	V, VI, VII, XVII, XVIII, XIX.
P. campestris.	120	6	77	35	7	XIV—XVI.	VI VII,XVII,XVIII,XIX
P. kamakurensis.	120	7	79	33	10	XIV—XVI.	VI, VII, VIII. XVII, XVIII.
P. parvula.	32	2	48	24	0	XIV—XVI.	0
P. heteropoda.	100	4	117	32	12	XIV—XVI.	VI, VII, VIII, IX.
P. obscura.	80	4	76	36—37	14	XIV—XVI.	XVIII, XIX.
P. scholastica.	155	5	127	39—48	8	XIV—XVI.	0
P. decimpapillata.	150	4	115	36	10	XIV—XVI.	VII, VIII, XVII, XVIII, XIX
P. flavescens.	120	6	126	20	7	XIV—XVI.	VII, VIII, IX, XVIII.
P. producta.	140	6	120	35—39	8	XIV—XVI.	VII, VIII, XVIII.
P. micronaria.	55	3	102	28—30	8	XIV—XVI.	XVIII, XIX.
P. vittata.	120	6	68	57	0	XIV—XVI.	0
P. grossa	240	8	141	53—57	9	XIV—XVI.	XIX, XX, XXI.
P. schizopora.	78	4	96	53	0	XIV—XVI.	0
P. Takatorii.	314	12	120	51	8	XIV—XVI.	XVIII.
P. candida	150	6	95	44—46	12	XIV—XVI.	VI, VII, VIII, XVIII.

THE BODY-CAVITIES OF THE STAR-FISH.

By SEITARO GOTO.

First High School, Tokyo.

In a paper on the metamorphosis of *Asterias pallida* (1) published a short while ago I have come to conclusions, which are in several respects contradictory to those arrived at by others from a study of other species. In particular, my results, while confirming those of MACBRIDE (2) in many essential points, could not at the same time be reconciled with them in several not unimportant details. To see if these differences are to be explained by the principle of personal equation or are really due to differences of species I obtained some material of *Asterina gibbosa* from the Zoological Station of Naples and have made a close comparison with the species formerly studied by me. The result was that, while the embryological differences of the two species are not so great as might be inferred from a comparison of the published accounts, yet are in some respects decidedly conspicuous.

The enterocœl of an adult star-fish consists, aside from the axial sinus and some other smaller cavities, of two compartments entirely separated from each other by a continuous and somewhat complicated mesentery, one lying on the aboral side of the gut and the other mostly on the oral side. The former I have called the *epigastric* enterocœl, and the latter may be called the *hypogastric* enterocœl. In this paper I shall, in the first place, describe the relation of these two cavities to the larval body-cavities in *Asterina gibbosa* and compare it with what obtains in *Asterias*, and then treat of some of those accessory cavities above referred to; confining our attention to general features and reserving the details for another paper accompanied by plate, to be shortly published in the Journal of the College of Science, Imperial University of Tokyo.

The various enterœlic cavities that arise during development and their genetic relations to the four portions of the larval enterœl in *Asterias pallida* may be diagrammatically represented as follows;

Right Anterior Ent'c'l....	Right Ant. Ent'c'l.	Ant. Ent'c'l. = **Axial Sinus.**	
Left Anterior Ent'c'l......	Left Ant. Ent'c'l. **Hydrocœl.**		
Right Posterior Ent'c'l....	**Epigastric Ent'c'l.** ½ Right Post. Ent'c'l...	Secondary Left Post. Ent'c'l.	**Hypogastric Ent'c'l.**
Left Posterior Ent'c'l......	Left Post. Ent'c'l. ..... Periœsophageal Ent'c'l .... **Dorsal Sac.**		

As an explanation of this diagram the following may be added. The two anterior enterocœls unite at a very early stage, and the hydrocœl is formed from the left enterocœl at about the same stage. The united anterior cavities remain in the adult animal as the axial sinus. The two posterior enterocœls unite on the ventral side, but very soon about one-half of the right posterior enterocœl is cut off from the rest by the formation of a secondary septum; this is the epigastric enterocœl. The remaining single cavity is what I have called the secondary left posterior enterocœl, and is destined to form a large portion of the hypogastric enterocœl. The periœsophageal enterocœl is budded out from the left posterior enterocœl after its union with the right. The dorsal sac also arises from the left posterior enterocœl, but at a very early stage. The cavity whose names are printed in full-face are those that persist in the adult star.

Turning now to *Asterina gibbosa* we see that the epigastric enterocœl is formed by a precisely similar process as in *Asterias*. MacBride (2) calls it "right posterior" enterocœl, as does Bury for *Bipinnaria asterigera* (3); but careful observation shows that it is something quite different from the right posterior enterocœl of the larva. It is true that on the right side there is no natural boundary line between the anterior and posterior enterocœls, but I think there is no valid objection to the criterion I adopted in my paper on *Asterias*, viz. to regard the transverse plane passing through the pore-canal as the boundary line between the two enterocœls, the anterior and posterior. With this criterion in mind, if we look on the right side of a larva of *Asterina gibbosa* in about stage D of MacBride it is very plain that the mesentery separating the "right posterior" enterocœl of MacBride runs very obliquely from the postero-ventral corner of the larva anteriorly towards the pore-canal. This obliquity of the course of the mesentery was observed long ago by Ludwig, and is correctly represented in several of his figures (4, figs. 31 and 32). Again, the accompanying cut, which represents the ventral portion of a transverse section through the region under consideration of a

larva in an intermediate stage between stages C and D of MacBride, proves the same fact still more conclusively. Here one sees the primary mesentery dividing the left posterior from the right posterior enterocœl still persisting but considerably thinned out, while at a short distance from it on the right side there has been formed a second septum by the apposition of the peritoneal walls. The primary mesentery subsequently ruptures and leaves no trace, while the secondary septum is gradually completed and finally becomes a true mesentery by ingrowth of the mesenchyme and the consequent separation of the two secondarily formed cavities. The one lying entirely on the right side is the epigastric enterocœl, and the other lying mostly on the left side and extending on to the ventral side is the secondary left posterior enterocœl. It is evident from what has been said that the latter is equal to the left posterior enterocœl of the larva plus about one-half of the right posterior enterocœl of the same. This is also true of *Asterias pallida*.

a epigastric enterocœl, *b* portion of the right posterior enterocœl cut off from the rest, *c* left posterior enterocœl.

The circular enterocœl and a portion of the perihæmal system arise in *Asterina gibbosa* in a very different way from what takes place in *Asterias pallida*. According to MacBride the entire perihæmal system of authors, viz. the circular enterocœl plus the perihæmal system of the present writer, arises in the form of five interradial out-pocketings of the secondary left posterior enterocœl. According to my observations there are only four interradial out-pocketings from the secondary left posterior enterocœl, viz. in interradii 4-5, 2-3, 3-4, and 5-1.* In interradius 1-2 the out-pocketing is replaced by the axial sinus (anterior enterocœl). The four out-pocketings, after being completely divided off from the secondary left posterior enterocœl, grow towards, and unite with, each other and with the axial sinus, and forms a complete ring. This ring is subsequently divided into two concentric portions by the formation of a septum; these are the two perihæmal ring-spaces of authors. Before the formation of this secondary septum, however, the peripheral portions of the four out-pocketings and the oral portion

* Adopting MacBride's notations.

of the axial sinus grow outwards (i.e. towards the periphery of the disc) in two horns, which again grow in, each towards the next adjoining radius and there become apposed to similar horns from the next interradii. These horns lying in the radii unite with the other portions of the perihæmal system, which have a quite different origin.

The portions of the perihæmal system lying peripherally from whithin the first pair of tube-feet arise in *Asterina gibbosa* in exactly the same way as the entire system does in *Asterias pallida*, viz. as separate solid masses of mesenchymatous cells lying in pairs on the oral side of the radial water-vascular tubes, between the successive pairs of tube-feet. These solid masses subsequently acquire lumen and growing towards each other unite. The radial septum, i.e. the septum between the members of each pair, is never absorbed. This would seem to reduce our conception of the origin of the perihæmal system to chaos, but in the face of observed facts we should only wait for a higher generalisation to bring harmony into the subject. It may be added that we have parallel cases in other groups, where the same organ arises differently in different species (collar-cavity in Enteropneusta, certain organs in the bud-development of ascidians).

In conclusion I must refer to the so-called "dorsal sac." MacBride claims to have proved the origin of this organ from the right anterior enterocœl, and he therefore regards it as the homologue of the hydrocœl on the left side and calls it the "right hydrocœl." To support his opinion he refers to certain abnormal larvæ in which there were pore-canals on both sides of the body, the one on the right side opening into the supposed right hydrocœl. I have not had the good fortune of coming across any similar abnormality; but the observation of normal larvæ has led me to a very different conclusion, entirely confirmatory of my observation on *Asterias*.

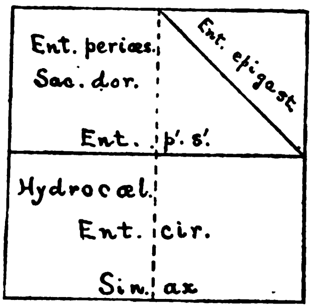
The cavity in question arises in fact from the anterior end of the left posterior enterocœl. Its right end is closely apposed to the wall of the right posterior enterocœl, as in *Asterias*, but there is at no time any connection between the two. Its origin from the left posterior enterocœl is, on the contrary, very distinct and unmistakable. The series of sections that I shall reproduce in my full paper will, I think, put the matter beyond doubt. MacBride's idea of the homology in question is thus entirely deprived of its ground.

The differences above sketched between *Asterias pallida* and *Asterina gibbosa*

may be shown by the adjoined cuts, in which the four smaller squares represent the four portions of the larval enterocœl. The broken lines represent the partitions, real or imaginary, that obtain in the larva, and full lines the partitions that obtain in the adult. The names of the different cavities are written within the parts of the larval enterocœl from which they arise.

Posterior.

Left.



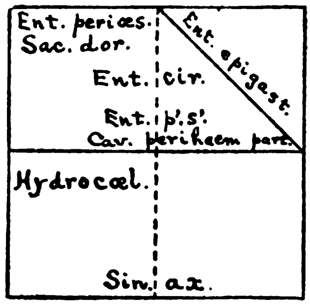
Right.

Anterior.

Asterias pallida.

Posterior.

Left.



Right.

Anterior.

Asterina gibbosa.

Ent. periœs.	Periœsophageal enterocœl
Ent. cir.	Circular enterocœl.
Ent. epigast.	Epigastric enterocœl.
Ent. p' s'.	Secondary left posterior enterocœl.
Cav. perihæm part.	Perihæmal cavities partly.
Sin. ax.	Axial sinus.

It may be added that this diagram may be directly derived from nature by viewing the larva from the ventral side and supposing the body to be cut open in the dorsal mid-line and spread out flat, and imagining the larval enterocœls as squares.

LITERATURE CITED.

1) Goto, S.—The Metamorphosis of Asterias pallida, wit Special Reference to the Fate of the Body-cavities Journ. Coll. Sci, Imp. Univ., Tokyo. Vol. X, Pt. III. '98.

2) MacBride, E. W.—The Development of Asterina gibbosa. Quart, Journ Mic. Sci. Vol. 38, Pt. III. '95.

3) Bury, H.—The Metamorphosis of Echinoderms. Quart. Journ. Mic. Sci. Vol. 38, Pt. I. '95.

4) Ludwig, H.—Entwicklungsgeschichte der Asterina gibbosa Forbes. Zeitsch. f. wiss. Zool. Bd. 37. '82.

Printed September 30th, 1898.

ON A NEW RHIZOPOD PARASITE OF MAN (AMŒBA MIURAI N SP)

By Prof. I. IJIMA. Ph. D

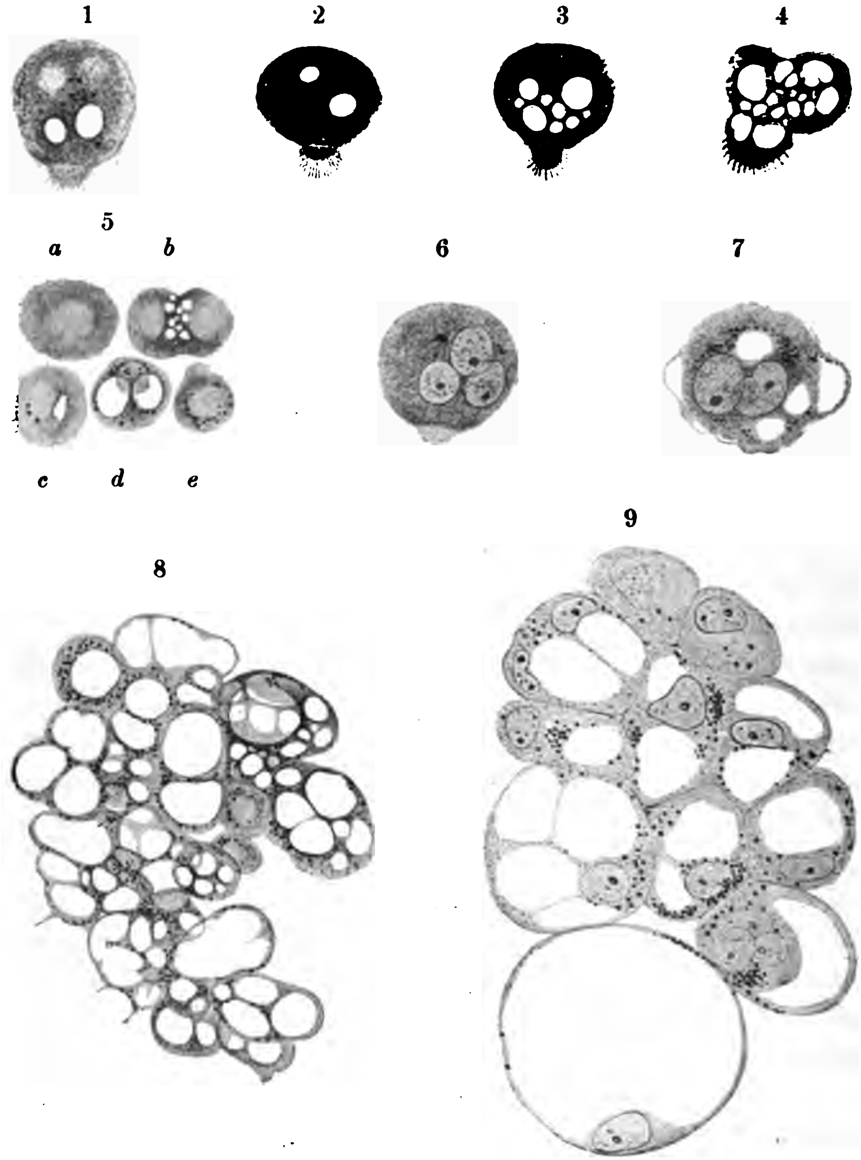
The Rhizopod parasite of man, reported on in this paper, apparently represents a hitherto undescribed species of Amœbæa. I take pleasure in proposing to call it *Amœba miurai* after Prof. K. MIURA of the Medical College, Imperial University of Tokyo, who first discovered it and kindly handed over to me the materials for study and description. The patient, who harbored the parasite, was a married woman, Yuki Ishiwatari by name and twenty-six years of age. She resided in the Prefecture of Kanagawa until she was taken into the University Hospital at the end of November last year. Her disease consisted at first in abdominal tumors which could be felt from outside and in ascites-like accumulation of fluid in the abdominal cavity. Later the affliction increased the degree of malignance and extended itself into the left pleural cavity. The patient finally succumbed in August of the present year. As the result of clinical and post mortem examinations Prof. MIURA has arrived at the conclusion, that he had to do with a case of *peritonitis* and *pleuritis endotheliomatosa*. For the details of this case from medical standpoint I refer those interested to a forthcoming paper of Prof MIURA himself, which will appear in the "Mittheilungen aus der medicinischen Facultät der Kaiserlichen Universität zu Tokyo."

It was in the serous fluid-accumulation of the peritoneal as well as of the pleural cavity that the Amœbæ were found in abundance. Only during a period of about two days, shortly before the patient's death, they were also present in the fæces concomitantly with hæmorrhage in the intestine; at other times the fæces were free of them.

The discovery reminded us at once of *Leydenia gemmipara* Schaudinn, a human parasitic Rhizopod discovered two years ago in Berlin under almost identical circumstances.* However, it was evident without going into discriminating

---

* v. Leyden and Schaudinn: Sitz ber. d. k pr. Akad. d Wiss. Berlin, 189?, XXXIX.



Amœba miurai Ij.

All figures magnified 500 times. Figs. 1—5 and 8 drawn from fresh state; figs. 6, 7 and 9, after treatment, with acetic acid.

Fig. 1.—A living specimen, with the surface in slow wave-like motion. Below, the villous knob beset with short pseudopodia. Internally, two vacuoles with sharp contour, two nuclei represented by ill-defined clear spaces and a few oil-like corpuscles.

comparisons that the present Amœba represents a form quite distinct from the one just mentioned.

The serous fluid, obtained from time to time by repeated punctures, was always of the same nature and appearance, well agreeing with v. LEYDEN'S account (loc. cit.) of the ascites-fluid in which *Leydenia gemmipara* was found. It was of a dark-reddish color on account of a large proportion of the blood it contained. When left standing for a few hours in a vessel, it separated into a serum of yellowish colour with greenish fluorescence and a thick sediment of dark-red color. The latter, when examined under the microscope, revealed the usual elements of a blood-coagulum (red and white blood-corpuscles, fibrin net-work) besides a variable number of what appeared to be endothelial cells in the process of fatty degeneration and a multitude of peculiar bodies, the Amœba to be presently described (*vide* annexed half-tone cuts).

These were by no means uniform in appearance. While some showed a very characteristic shape and were evidently alive, others were abnormally vacuolated more or less swollen and apparently dead or nearly so. It is a noteworthy fact that both dead and living specimens were found together even in the fluid examined on warm stage immediately after extraction.

Individuals in living and consequently normal state (figs. 1—3) were found always isolated, never adhering together in clusters. The body of such is habi-

---

Fig. 2.—Same as above, the pseudopodia on the knob extended filament-like. Nucleus not visible. Vacuoles and oil-like corpuscles as in fig. 1.

Fig. 3.—Another living specimen, in which the villous knob is bounded against the main body by a shallow ring-groove. Several vacuoles within; above these the nucleus is indicated by the clearer appearance of the sarcode.

Fig. 4.—A fresh specimen in the first stage of becoming morbid, but still showing some pseudopodia. The knob bearing the latter is being encroached upon by the vacuoles which are enlarging themselves by imbibition.

Fig. 5.—Small, probably young specimens. *a*, with uneven surface; neither vacuoles nor oil-like corpuscles present, but with nucleus indistinctly recognizable at centre. *b*, biscuit-shaped and the two nuclei so disposed as if in process of cell-division; several small vacuoles and a few oil-like corpuscles at the middle. *c*, the surface uneven and with pseudopodia-like processes; a single small vacuole and a scanty number of oil-like corpuscles present. *d*, spherical, with three vacuoles and a fair number of oil-like corpuscles In all the above figures the villous knob is either concealed from view or not developed at all. *e*, with unmistakeable knob but without villi or pseudopodia; no vacuole; numerous oil-like corpuscles around the nucleus.

Fig. 6.—A specimen treated with dilute acetic acid solution. Pseudopodia on the knob retracted; three nuclei made distinctly visible; no vacuole.

Fig. 7.—A similarly treated specimen with two nuclei. The knob is either concealed or obliterated. The vacuoles have lost sharpness of contour. The accumulation of imbibed fluid has caused the pellicle to heave up, pustule-like, at several places.

Fig. 8.—Portion of a large mass formed by the cohering together of dead, strongly vacuolated individuals. Seen in fresh state.

Fig. 9.—A similar cluster of dead individuals, seen after treatment with acetic acid (greatly swollen but nuclei made distinct).

tually spherical or more frequently ellipsoidal, characterized by having at one pole a small rounded protuberance, which on close observation is found to bear on its surface a number of fine processes, the pseudopodia, closely set and extended to a greater or less degree. The protuberance is apparently the same structure as the " villous knob " or " Zottenanhang " which has long been known to characterize the hind end of certain species of Amœbæa (*Amœba villosa* Wallich, *Am. fluida* Gruber, *Pelomyxa villosa* Leidy).*

The size of the body is variable within certain limits. Large specimens have a diameter of 38 μ, while the smallest may measure not more than 15 μ across. They never attain the size of *Am. fluida* (80—90 μ, according to GREEFF), which, of all the Amœba species known to me seems to come nearest to the present one in several respects.

The sarcode is, apart from its enclosures, clear and uniformly finely granular, without perceptible differentiation into the ectoplasm and the endoplasm except at the villous knob. The substance of the latter is clearer and hyaline, without enclosures of any kind. I think I may say that it represents the main, if not the entire, mass of the ectoplasm of the present species, localized as it were at the spot in questien. This view also coincides with the fact that the general surface never involves itself in any considerable movements.

The villous knob may be papilliform or hemispherical in shape, measuring about 10 μ across at the base. At other times it is only a gentle elevation and under certain circumstances, may even be entirely retracted or obliterated. On small specimens, such as represented in fig. 5 *a*—*d*, I have frequently missed the knob. It is possible that in some of such cases it was simply concealed from view, being situated at a position turned away from or towards the sight; in certain other cases however I was convinced of its absence. In these latter cases, short

---

* *Am. villosa* is a fresh-water species first discovered and described by WALLICH in England (Ann. & Mag. Nat. Hist. 1863). Whether the forms reported under the same name by LEIDY (Fresh-water Rhizopods of N. America, 1879) and by MÖBIUS (Rhizopodenfauna der Kieler Bucht; Abh. d. k. pr. Akad. d. Wiss. zu Berlin, 1888) were correctly identified, seems to require corroboration.—*Am. fluida* is a marine species first described by GRUBER (Z. f. w. Z. BD. 41, p. 219) and later more precisely by GREEFF (Biol. Centralbl. Bd. 12, p. 374). This is a species that seems most to resemble *Am. miurai*.—*Pelomyxa villosa* was described by LEIDY in his "Fresh-water Rhizopods of N. America," p 75.—All these species have in common with *Am. miurai* the characteristic villous knob, though it can not be said that this structure is strictly confined to the species mentioned. As to the specific distinction between *Am miurai* and the three species above cited let it suffice to mention here that the latter are all much larger in size, are capable of active, typically amœboid or flowing motion with the main body and inclose in the endosarc crystals, pigments or peculiar bodies such as are not observed in *Am. miurai*.

villi-like pseudopodia were sometimes found emanating in irregular distribution from the general surface (fig. 5, *a* & *c*), what might be expected to occur in immature individuals so long as these would be naked and the ectoplasm not concentrated into a knob.

It sometimes happens in life that the villiform pseudopodia are entirely retracted. The knob then presents a smooth surface (fig. 5, *e*), as it does always when acted upon by reagents (fig. 6). Otherwise it is beset with shorter or longer pseudopodia as the case may be. When short, the pseudopodia are generally conical in shape and comparatively thick though minute (fig. 1). By focussing up and down the microscope, it was easy to observe the knob-surface closely studded over with them. When fully extended (fig. 2), they may reach 5 μ in length and are extremely fine, broadest at base and thinned out towards end. They then seem to radiate forth in tolerably straight course. Although I do not remember having ever seen them branch or anastomose, yet I do not feel myself sufficiently warranted to exclude the possibility of such occurrence. The actual movement of the pseudopodia, whether molecular or otherwise, could not be watched in continuous succession, what is sufficiently accounted for by the slowness of motion combined with the fineness and the hyaline nature of the pseudopodia. On the other hand, by examining the same living object at intervals of several minutes, I could plainly observe, under favorable circumstances, the variation in the degree of contraction or elongation of the filamentous structures under consideration,—evidence enough that these are to be seen in the light of pseudopodia and not of immobile villi. The same view has been put forward by GREEFF* for the identical structures of *Am. fluida.*

The so-called villous knob passes usually, though not always, insensibly into the main body. Not unfrequently, however, there were cases in which the two parts were separated externally by a tolerably sharp line of demarcation (fig. 3). This was brought about by the presence of a shallow ring-groove surrounding the basis of the knob. The appearance then is as if either the knob-base has just slightly sunk into the main body or the latter has elevated itself in a low wall around the former. This is without doubt only a temporary condition arising from a certain state of contraction of the sarcode.

---

* GREEFF: Biol. Centralbl. Bd. XII, p. 377.

To all appearance the villous knob is naked, i.e., devoid of an external enveloping membrane The same can not be said of the main body. An indubitable, double-contoured membrane is indeed not directly demonstrable in either fresh or prepared specimens under ordinary circumstances. The contour-line of the main body appears sharp but is simple. Nevertheless, it often happens after death that the entire Amœba is blown out into a thin-walled vesicle by the excessive enlargement of the vacuoles contained, then to remain in that state for a considerable length of time, giving an impression as if the tension of a special superficial layer resisted its speedy bursting. Again, should the animal be left for some time in a dilute solution of acetic acid, the fluid imbibed into the sarcode frequently accumulates itself in the form of vacuoles just under the surface and heaves up from below a pellicle in a pustule like manner (fig. 7). These appearances have led me to infer that a thin elastic layer of a firmer consistency than the internal sarcode covers the whole surface, interrupted only at one spot by an opening through which the pseudopodia-producing ectoplasm is protruded knob-like into the exterior. This would be exactly the same state of things as has been described in certain near allies of the present species, e. g., in *Amœba fluida* by GREEFF,* in the genus *Plagiophrys* by ARCHER† and PENARD‡, a condition that leads over to that seen in the soft-shelled, monothalamous and monostomatous Rhizopods. In *Am. fluida* the membrane should be thicker and more distinct than in the present species.

The main body is not altogether incapable of changing its form but unlike its known nearest allies *Am. villosa* and *Am. fluida*, the motion is so slow and limited in extent that it requires close observation to perceive it. The shape may change from spherical into ellipsoidal or *vice versa* and at times assume a somewhat irregular outline. In one case I have observed a slow wave-like movement of the surface, so that the latter presented a slightly verrucose appearance (fig. 1). A "flowing" motion of the sarcode or such active transformation of the body into lobate pseudopodia as is ascribed to *Am. villosa* or *Am. fluida*, was never noticed. On the contrary, the various enclosures retained tolerably constant relative positions all the while during observation. It seemed as if the

---

* GREEFF: loc. cit., p. 375.
† ARCHER: Quart. Jour. Micr. Sci. Vol. XI.
‡ PENARD: Mém. Soc. Physiq. H. N. Genève, T. XXXI, No. 2.

sarcode were not of sufficiently fluid nature as to allow of a far-reaching change in the body-form. So then, *Am. miurai* must be said as being of a very sluggish habit. On this account and from consideration of certain fact to be mentioned further on but which indicated that the Amœba was not fit for prolonged existence in the serous fluid containing it, I have naturally questioned myself if the forms I have considered as normal and healthy were really such and not already in the first stage of contraction. But I think this doubt can be done away with as being unfounded, for, were the animal in any way pathologically affected, the power of emitting and retracting those delicate pseudopodia on the knob should be the first to disappear.

The enclosures in the main body are the nucleus, the vacuoles and the minute oil like corpuscles. They occur in the finely granular sarcode without any definite rule as to their positions.

The nucleus is generally invisible in the fresh or living state, at most only indistinctly indicated by an ill-defined, somewhat clearer space in the sarcode (figs. 1—5). When treated with the acetic acid, it comes forth with all the desirable distinctness (figs. 6,7 & 9). It occurs in twos or threes almost as often as it does in a single number. Round, oval or kidney-like in shape, it is bounded by a distinct nuclear membrane. The diameter measures 8—15 μ. The nuclear fluid is faintly granular, somewhat clearer than the sarcode and encloses within one or more prominent nucleoli, generally one in number.

The vacuoles are perfectly clear and form very conspicuous objects in fresh specimens, being very sharply outlined against the sarcode. They are inconstant as to their number and size. In some, notably smaller, individuals (fig. 5, *a* & *e*; fig. 6), they were found to be even entirely missing. But the majority of individuals showed them in numbers of one, two, three or several (see figs.). I think none of these vacuoles is pulsatile. Once a vacuole in a specimen, the first examined from a freshly taken abdominal fluid, was seen to vanish from view as slowly as it again reappeared; but then I was at a loss to decide, whether or not, the phenomenon was simply due to that vacuole getting alternately into and out of the focus as the object slowly rolled about under the cover-glass. Treated with acetic acid, the vacuoles lose the boldness of contour, while the large vesicular nucleus, hitherto concealed, is made perfectly clear. In the number, size and non-contractility of the vacuoles the present species seems to agree exactly with *Am. fluida* as described by GREEFF.

The oil-like corpuscles are small yellowish, highly refractive spherules of by no means uniform size. They are probably nutritive matter in reserve and identical with similar bodies that are so commonly met with in the body of other Amœbæ. Some individuals contained only a small number of these corpuscles, others in fair abundance. Also cases were not wanting in which not a trace of them was to be found.

Crystals and extrinsic matter, such as food-particles, &c., were not met with in the sarcode. Nor was the animal ever seen in the act of taking in food, which process, in my opinion, could only take place by means of the villiform pseudopodia at the knob. Whether the latter, like the similar organ of *Pelomyxa*, served at times for prehension, I have not been able to ascertain.

The above is the description of *Amœba miurai* in what I consider its normal living state. Now besides such individuals, the serous fluid also contained a large quantity of peculiar cells, which were unmistakably nothing else than dead, at any rate much changed, bodies of the same animal. These are usually globular or more or less irregular in shape and of about the same size as normal individuals or larger on account of their swollen state. They are found either isolated or clinging together in variable numbers and forming conglomerate-like clusters (figs. 8 & 9). Sometimes such clusters are as large as to present a dimension of almost half a millimeter. The cells are characterized by having one or several large vacuoles that press the scanty protoplasm and the nucleus between them or against the peripheral wall. They often present the form of thin-walled strongly distended vesicles. The protoplasm contains the same oil-like corpuscles as the normal specimens; the nuclei, made visible after treatment with acetic acid, are likewise exactly the same. The villous knob and with it the pseudopodia have disappeared, leaving no trace whatever. A similar swelling was observed by Greeff in *Am. fluida* when left in certain liquids, the enveloping membrane then showing a gap at the position where the villous knob has disappeared. Such a gap was not visible in my objects, what was probably largely due to the thinness of the membrane. The cells have not the slightest power of active motion and I think no one, who sees them, will hesitate to consider them as dead and as being prevented from speedy bursting and collapse only by the presence of an enveloping membrane. The existence of transitional stages between the normally

conditioned *Amœba* and the cells in question definitely establishes the derivation of the latter from the former. In fig. 4 is represented a specimen which is evidently on the verge of becoming morbid. It still shows signs of life inasmuch as it possesses some pseudopodia, but the knob is stretched out to a great extent by the vacuoles that are encroaching upon it. Indication is not wanting that a part of the swelling contents has protruded itself hernia-like through the opening of the enveloping membrane. Should the pseudopodia in such a specimen cease to exist with the extinction of life and the body swell somewhat more as the result of imbibition, the metamorphosis into the state of the above described cells would be completed.

As already mentioned, both the living and the dead individuals were found together even in the freshest fluid, still warm and guarded against injurious influences. Care was taken to sterilize all the wares and instruments that were to come into contact with the fluid and observations were made by means of a microscope to which was fixed an arrangement that effectually kept the preparation at the normal body-temperature. Examined under such precautions, every preparation made of a drop of the fluid always contained the *Amœba* in the two conditions referred to, in such a number that it hardly ever needed a much prolonged search to come across one or the other kind, even though the power used were a moderately strong one. Preparations of the sediment, that formed itself after standing for some time, of course contained the parasites in much larger proportions, the majority of which were dead and adhering together in clusters. In the fluid kept overnight, they were almost all, if not without exception, dead and much swollen up. It is important to mention that it made no difference on their mortality whether the fluid was allowed to cool or kept in a warm chamber at the body-temperature ever since its extraction. Let it be also mentioned here that I have not been able to observe the mode of reproduction, beyond what is suggested by the possession of more than one nuclei or the occasional occurrence of biscuit-like forms (fig. 5, *b*).

The above observation tends to show, in my opinion, that the serous fluid was not a medium fit for the parasite to continue its vigorous existence,—that the real place of its parasitism is to be sought somewhere else than in the fluid that contained it. The parasites were evidently dying off in the serous fluid while

still within the patient's body-cavity. Above all then, the tissues of the tumors suggest themselves as most likely the proper home of the parasites, whence they might have fallen into the fluid-accumulation of the body-cavity or into the alimentary canal by rupture. At the post mortem examination, which was undertaken eighteen hours after death, Prof. MIURA found a number of dead, swollen and motionless Amœbæ on the surface of the tumors. Further results of his extended researches on the pathological parts remain yet unknown to me. It is hoped that in his forthcoming report he will be able to bring forward facts which will help to clear up the question of the relation that the parasites bore to the patient's disease.

In conclusion I wish to express my thanks to Prof. K. MIURA for supplying me with both materials and informations, without which I could never have been able to complete this report.

Tokyo, Aug. 31st, 1898.

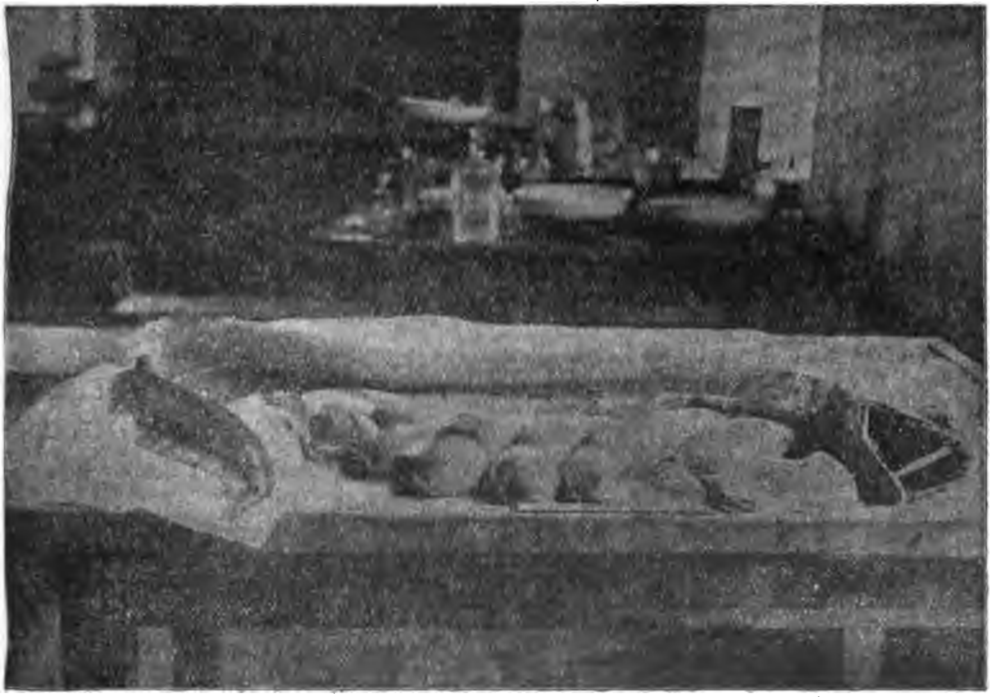
Printed October 3rd, 1898.

NOTES ON SOME EMBRYOS OF CHLAMYDOSELACHUS ANGUINEUS GARM.*

By T. NISHIKAWA.

Fisheries Bureau, Department of Agriculture and Commerce, Tokyo.

With Pl. IV.



So far as our present knowledge is concerned *Chlamydoselachus anguineus* is confined in Japanese waters to the sea of Sagami; but we are not able to point out the precise part where the shark lives. We only know that it is occasional-

---

* Having been asked to look through and prepare for publication Mr. NISHIKAWA's manuscript on the embryos of *Chlamydoselachus*, I have prepared the following notes, which though confessedly fragmentary, deserve perhaps to be put on record as referring to a rather rare form. The manuscript had been finished in June of the last year, and hence no reference is made to COLLETT's paper recently published (On *Chlamydoselachus anguineus* A remarkable Shark found in Norway.) Mr. NISHIKAWA tells me, however, that the female genital organs of *Chlamydoselachus* are essentially like those of other sharks, and I can confirm his statement from a passing examination of a specimen brought some time ago to my laboratory. COLLETT's description of these organs appears to me irrelevant.—S. GOTO.

ly brought to the Tokyo market by fishermen from Bōshū, on the eastern side of the Bay of Tokyo, and also that it is sometimes, though very rarely, caught by the fishermen of Misaki. The ordinary fishing apparatus must be ineffective against such sharp teeth, and it must be largely by chance that specimens of this interesting shark are occasionally brought up from the deep. Nevertheless I have been able to obtain a few developmental stages, and I propose in this paper to make a few notes on them.

Chlamydoselachus anguineus is viviparous, and the breeding season is spring, extending from about the end of March to the beginning of June. The left oviduct is always rudimentary,* but the nidamental gland of the right side is better developed than that of the opposite side. The right oviduct is very much distented and contains from 3—12 eggs, these numbers being the limits observed in seven specimens. The oviduct is only about 60 cm. long, and one can imagine the degree of its distension when as many as twelve eggs, each 11—12 cm. long, are contained in it.

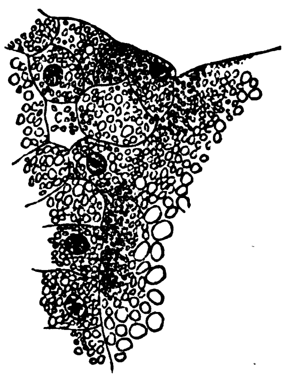
The egg is ellipsoidal, and varies between 6.5—7.5 cm. in its shorter diameter and 10.2—12.4 cm. in its longer diameter, the measurement being made in the physiological solution of salt (fig. 1 & 2). It bears a stumpy excrescence at one end and a slightly recurved flattened process, about 3.5 cm. long, at the other. The capsule is light brown and transparent. The space between the capsule and the yolk-sac is, in earlier stages, very insignificant, being confined mostly to the two poles of the egg, and is filled with the white, which is very fluid. The yolk is of a pinkish color, and the yolk-sac is very delicate. Hence it frequently happens that the contents of an egg get all mixed up during transportation.

The blastoderm has a yellowish red color, as in other sharks. The earliest stage that I have been able to obtain was nearly circular in form and had the diameter of 1.3 mm. The next stage was a blastula, with a distinct segmentation cavity, whose floor was bounded by what has been termed "periblast" with finely granular yolk, and merocytes, with vacuolated cytoplasm, due perhaps to the dissolution of the contained oil drops, and many nuclei. One end of the blastula was thicker than the other, and is evidently the "embryonic end" of BALFOUR,

---

* When no eggs are contained there is no perceptible difference in size between the two oviducts.—S. G.

and the "anterior end" of RÜCKERT. On the surface of the blastoderm the cells are arranged epithelially. Most cells of the blastoderm are rich in yolk granules, but at the bottom of the blastoderm they have only a coarsely granular cytoplasm. The blastodermic cells are added from the periphery by the merocytes with fine yolk granules, as may be seen from cut 1, which has been composed from two consecutive sections. I have also found a cell simply resting on the floor of the segmentation cavity; but I cannot say for certain whether it originated from the periblast or from the blastoderm. Besides the stages mentioned above I have also obtained a gastrula, which was oval in form and 3 mm. in length. I have nothing special to add about it, as it was like the gastrula of any other shark.



Cut 1. Zeiss 4 DD.

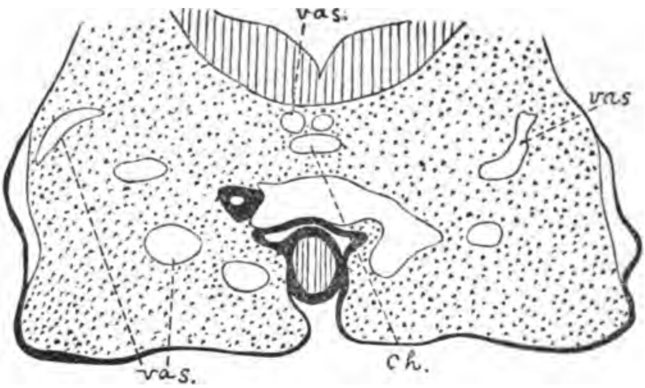
The youngest batch of embryos was obtained from a specimen 170 cm. long, which was brought to the University on the 26th of May (1896). There were six embryos 32, 35, 43, 48, 50, and 60 mm. long respectively. Each embryo was attached to its large yolk-sac by means of an umbilical cord, which allowed considerable movement to the embryo. The circulation in the yolk-sac could be clearly traced and is reproduced in figs. 1 and 2. On leaving the umbilical cord the artery and the vein run in opposite directions. The former receives on its course a number of smaller veins from the two poles of the yolk-sac, and divides finally into three main branches. The artery runs for some distance without giving off any branch, and then divides into two main vessels, which after running for a short distance parallel to each other, forms at last, on the opposite side of the yolk-sac, an elongated, irregularly shaped arterial ring, from which numerous small vessels radiate towards the periphery. The arterial ring just mentioned is still wide apart in the embryo of 32 mm., but in one of 43 mm. its two halves almost touch each other; but in other respects there is no change in the circulation. The embryos themselves are transparent, and the large liver-lobes with their blood vessels, the cardinal veins, and the trunk vessels can be seen from outside.

The embryo of 32 mm., the smallest one I have got thus far, may be compared with BALFOUR's stage M. The umbilical cord is 7 mm. long and 2.5 mm.

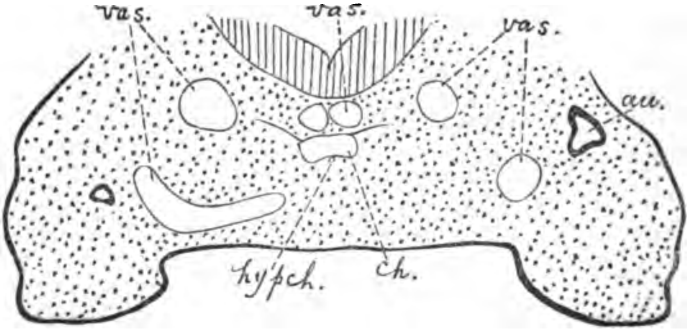
across. All the fins are clearly visible, and the nasal sacs are to be seen as two small pits. There are seven pairs of visceral clefts opening to the exterior, of which the second is widest and the hindmost smallest. The first cleft has now commenced to be metamorphosed into the spiracle. The upper jaw is still in the form of a transverse ridge, and its two halves are still widely separated in the median line. The external gills have begun to appear on each visceral arch, including the spiracle; and those of the second slit, or the first gill cleft of the adult are longest.

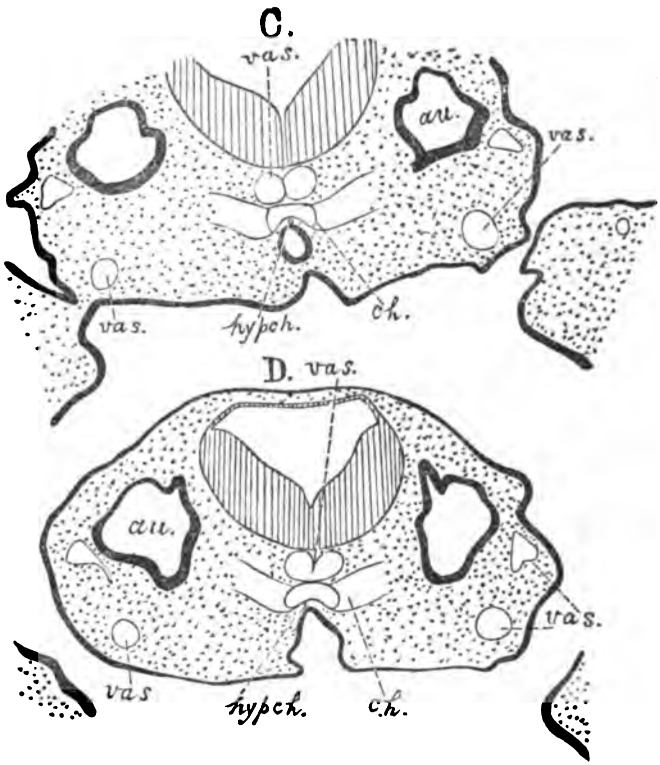
The head of this embryo is very different from that of the adult. In the dorsal or ventral aspect the snout is pointed, but in profie it is rounded; and there is a small depression between the fore and mid-brain (fig. 3), so that the head is already more or less compressed dorso-ventrally. In the dorsal view the *ducti endolymphatici* can be seen at the level of the first gill arch (fig. 6), and

A



B.





Cut 2.

Four transverse sections passing through the region of RATHKE's and SEESSEL's pouches, of the embryo of 32 mm. There are 47 sections between A & B, 19 between B & C, and 17 between C & D, each equal to 10 μ.

their external openings can be readily recognized from outside. In sections it is seen that the epiblast surrounding the openings is thickened. There is as yet no cloacal opening, but its position is marked by a distinct prominence, where the wall of the alimentary canal and the skin are in close contact. In the ventral view of the head a pit can be seen in the median line directly behind the depression separating the two halves of the upper jaw (fig. 5). This is RATHKE's pouch, or the pituitary involution, which is closely connected with the infundibulum. In cut 2 I have reproduced some of the transverse sections passing through this region. In A both the pituitary involution and the infundibulum are to be seen, the former extending for 36 sections (each=10 μ). About 0.405 mm. behind the posterior border of RATHKE's pouch there is another involution,

which, however, cannot be distinctly observed from outside. This is SEESSEL's pouch, and is seen in sections in C & D; it is in close contact with the hypochorda.

The anlage of the lateral line is clearly visible on either side of the body. It is very narrow for the greater part of its length, and it stops short at about the middle of the tail, where it is thickened and presents a club-shaped termination. Throughout the greater part of the lateral line there is a lumen, which is slit-shaped in cross-section, but at the posterior extremity it is absent. In the anterior part where the lateral nerve is in close contact with the anlage of the lateral line the lumen opens to the exterior at several points. Cut 3 is a cross-section through what may be called the "growing point" of the lateral line. The backward growth of the club-shaped termination of the lateral line is caused by the multiplication of the cells of the deeper part of the superficial layer of the epiblast.

Cut 3.

Cross-section through the "growing point" of the lateral line. Zeiss 4 BB.

The spiral valve of the intestine makes its appearance as a folding of the intestinal wall.

The embryo of 35 mm. presents no markedly different features from the one just described. The club-shaped termination of the lateral line has only proceeded nearer the tail end.

The embryos of 43, 48, and 50 mm. all resemble in their general features. The external gills are longer and the jaws are more conspicuous. Figs. 7 and 8 are two drawings of the front part of the embryo of 50 mm. It may be noticed that the openings of the nasal sacs are no longer circular, as it was in the embryo of 32 mm. The head is now much compressed dorso-ventrally. The spiracles have changed considerably and are now seen as a pair of small pits. The *ducti endolymphatici* and their external openings are clearly visible. The second visceral clefts, or the first gill slits, tend to unite on the ventral side.

The embryo of 60 mm. corresponds to BALFOUR's stage Q. The dorso-ventral compression of the head has proceeded so far that its form is essentially that of the adult. The spiracles are no longer visible on the outside; the lower jaw has grown forward, and the mouth has been reduced to a slit-like opening. The flaps of the first gilt arches, or the opercular flaps have grown together on

the ventral side, and has reached the definitive condition. In short, the embryo is now essentially like the adult, with the exception of the external gills.

EXPLANATION OF PLATE IV.

Fig. 1. An egg with embryo of 43 mm., seen from the embryonal side. Nat. size.
" 2. Ditto, seen from the anti-embryonal side. Nat. size.
" 3.
" 4.
" 5.
" 6. } Different views of the embryo of 32 mm. Zeiss 2 a_1.
" 7.
" 8. } Different views of the embryo of 50 mm. Zeiss 2 a_1.

Printed December 25, 1898.

Fig. 1.

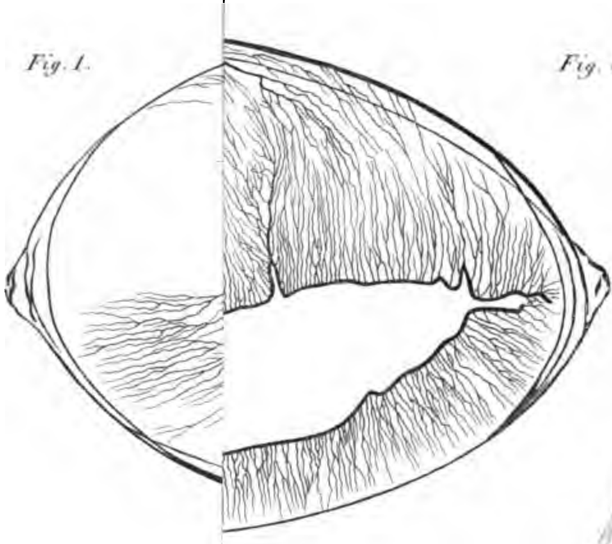


Fig. 4

Fig. 5.

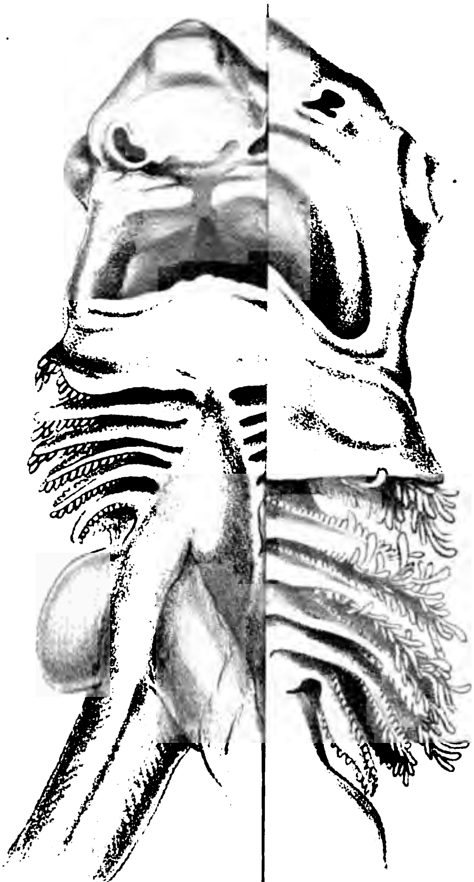
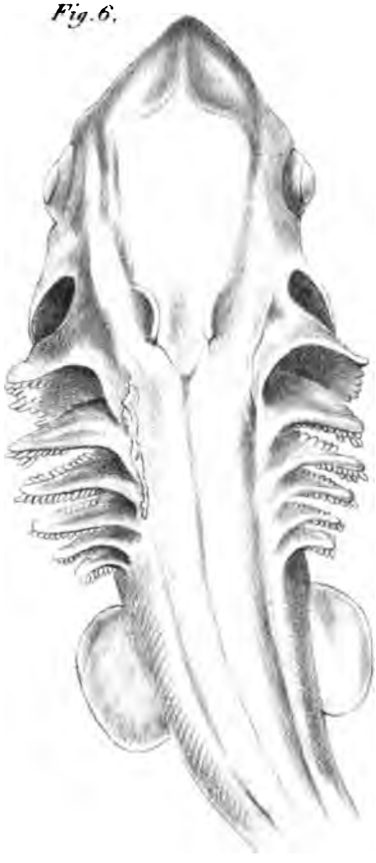


Fig. 6.



Lith et Imp. E. Koshiba.

ON VERMICULUS LIMOSUS, A NEW SPECIES OF AQUATIC OLIGOCHÆTA.

By S. HATAI.
First High School, Tokyo.

The present species is very common in the muddy gutters and ditches of our city, occurring together with *Limnodrilus*, *Tubifex* and other Limicolae. It creeps about on the lower surface of fallen leaves and other objects and rarely buries the anterior part of its body in the mud, as do most others; nor does it swing the posterior half of its body like the latter. The general color is tinged with a milky white and the intersegmental lines are blood red. It is very sluggish, and on being pinched never executes those writhing contractions, but simply retracts its body. These peculiarities serve to distingnish the present species readily from its cohabitants.

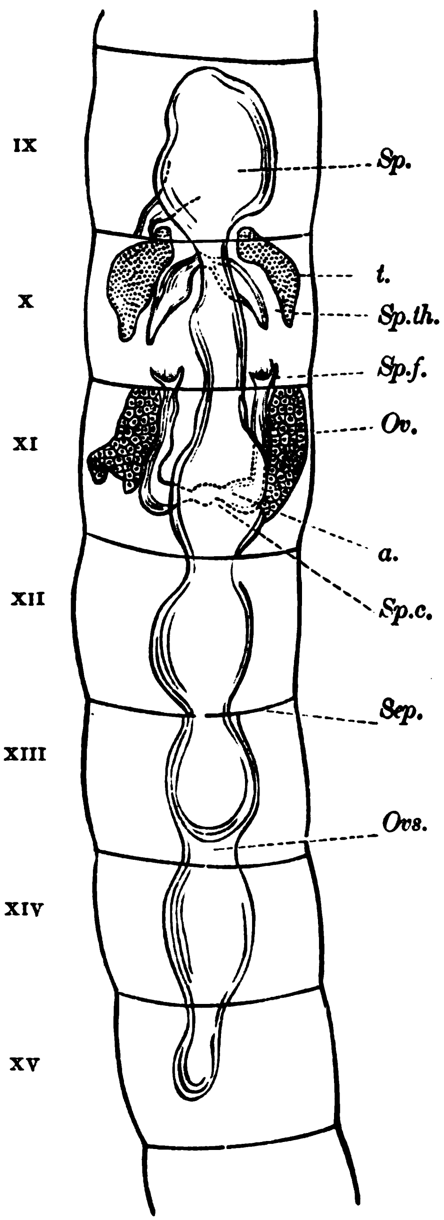
As measured on specimens killed with Perenyi's fluid after stupefying with weak alcohol, the body is 50—70 mm. long and 0.5—1 mm. wide. The segments number from 120 to 150 in sexually mature individuals. In the anterior part the body is cylindrical, but posteriorly it is somewhat flattened; the width gradually increases till about the middle of the body, but thenceforward it gradually diminishes. The prostomium is cylindrical and comparatively long. The clitellum is totally absent even in sexually mature specimens,—one point of difference from the known species of the genus, *Vermiculus pilosus* Goodrich.

The setæ are aggregated in bundles, which are arranged in four rows along the length of the body. Each bundle occupies in each segment the four corners of a square, and consists of 5—6 setæ in the anterior part and 2—3 in the posterior part; the setæ being all of the same size. Each bundle contains besides one or two small developing setæ in its setigerous sac. The setæ are all of the same form, being sigmoid and furcate at the end. There are no penial setæ.

The minute cilia-like processes on the body surface, supposed by Goodrich to be of a cuticular nature, can be observed with high powers; but in the present species they are closely set only in the posterior part of the body and gradually

---

* Translated and edited by S. Goto.



Cut 1.

a. Atrium, *Ov.* Ovary, *Ovs.* Ovi-sac, *Sep.* Septum, *Sp.* Sperm-sac, *Sp.c.* Spermiducal chamber, *Sp.f.* Sperm-duct funnel, *Sp.th.* Spermatheca, *t.* testis.

decrease as we proceed anteriorly. From the fifth segment on they appear to be entirely absent.

The cœlomic corpuscles are very numerous in segments II—X and hides the internal organs. In segment XI they are few, and gradually decrease in the more posterior segments, being very few in the segments next the anus.

The septa are thick; they are all set transversely to the alimentary canal, and are not funnel-shaped as is the case in the anterior segments of most other Oligochaetes.

Genital System.

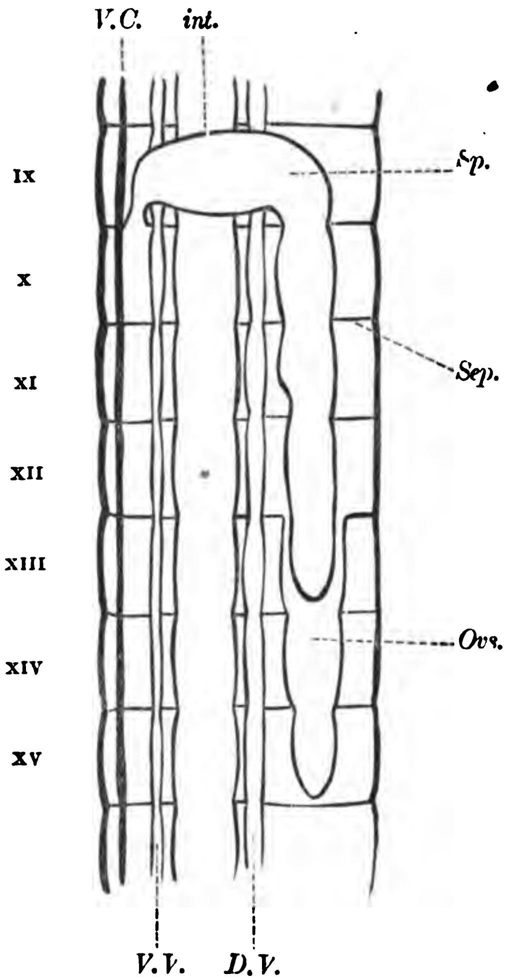
The genital organs present several points of difference from those of *V. pilosus.* I shall therefore describe them separately.

1. *Testes.*—One pair of testes are attached to the posterior face of septum IX/X, but a small portion of each testis projects into segment IX. The form varies according to development, but the posterior portion is usually finger-shaped.

2. *Sperm-sac.*—This is a single large sac extending from segment IX to segment XIII,

the larger portion of which lies on the dorsal side of the alimentary canal. In segment IX the posterior septum forms on the left ventral side an evagination towards the anterior, and this evagination is directly continued into the sperm-sac, which is very voluminous and is situated on the dorsal side of the intestine, in the median line. Of *V. pilosus* GOODRICH says (2, p. 261), "The spermatozoa are shed at an early stage of development into segment 10, and the anterior septum of this segment soon bulges out, forming a sac—the anterior sperm-sac. Later on this sperm-sac pushes its way across segment 9, through its anterior septum into segment 8. The hinder wall of segment 10 also bulges out, forming the posterior sperm-sac." In the new species before us these two sacs have become one and continuous. The walls of the sperm-sac are exactly like those of the ovisac to be presently described, and are covered with peritoneal cells on both surfaces. The hinder end of the sperm-sac projects into the cavity of the ovisac.

3. *Ovary.*—One pair attached to the anterior septum of segments X and almost reaching the posterior septum when fully developed, in which case the peritoneal covering is also very indistinct.

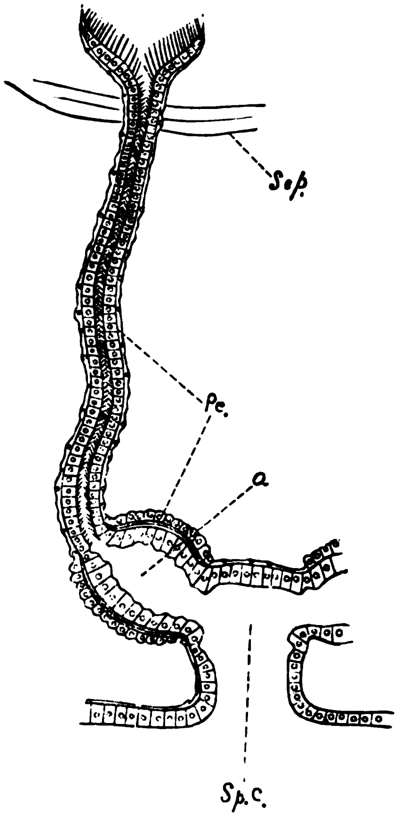


Cut 2.

D.V. Dorsal Vessel, *int.* intestine, *Ovs.* Ovisac, *Sep.* Septum, *Sp.* Sperm-sac, *V.C.* Ventral Cord, *V.V.* Ventral Vessel.

4. *Spermatheca.*—One pair in segment X, spindle-shaped, and situated between the two testes, on either side of the intestine. The single coalesced duct opens to the exterior on the ventral median line, directly behind the intersegmental line IX/X. The internal surface of the sac is lined with a non-ciliated epithelium, which is followed by a layer of longitudinal and of circular muscle fibres. The external surface is covered with peritoneal cells. No spermatophores could be observed in the spermathecæ.

5. *Oviduct.*—In *V. pilosus* the oviduct is stated to be rudimentary, being represented by a pair of depressions of the 12th septum. In the present species no trace of the oviducts could be observed either in transverse or longitudinal sections.



Cut 3.

a. Atrium, *Pe.* Peritoneum, *Sep.* Septum, *Sp.c.* Spermiducal chamber.

6. *Ovisac* (*Receptaculum ovorum*).—One pair in segment XIII, being formed by the backward bulging out, on the left dorsal side, of the anterior septum, and extending sometimes into the 15th segment but sometimes stopping short in segment XIV. The mouth of the sac is very large and opens, as a matter of course, into the cœlom of segment XII. The anterior part of the ovisac encloses, as already stated, the hinder end of the sperm-sac, but the posterior part is slender. The ripe ova are found not only in the ovisac but also floating in the cœlom of this region. (In *V. pilosus* the ovisac opens into the cœlom of segment XI)

7. *Sperm-duct.*—This is very different from that of *V. pilosus.* The funnel is relatively large and bores septum IX/X; it is continued into a slender duct, which, after running on the inner side of the ovary till about the

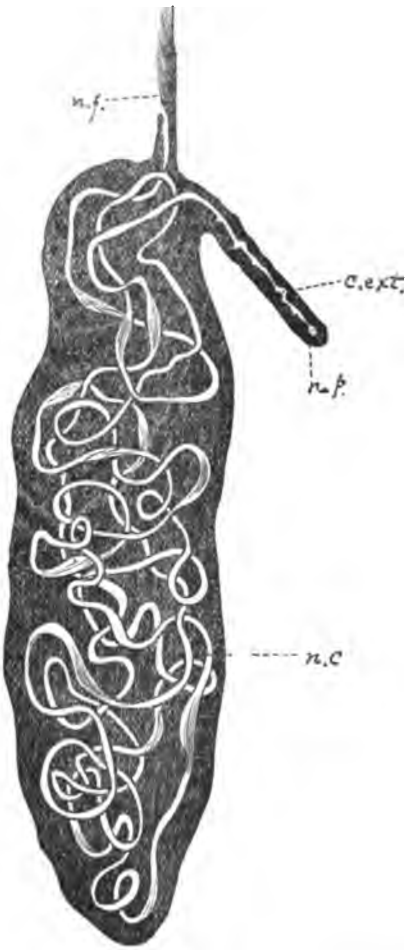
middle of segment X, curves slightly towards the median plane and opens into the atrium. The latter has a spacious ellipsoidal cavity and opens slightly in front of the setæ directly into the common sperm-duct chamber below the ventral cord, which is, as GOODRICH says, to be regarded as an invagination of the body-wall. In immature individuals the atrium is followed by a slender duct-like portion, but as the genital organs approach maturity the invagination of the body-wall becomes greater and the dorsal wall of the duct-like portion is converted into the roof of the sperm-duct chamber, and the atrium comes to open directly into the latter. Even in mature specimens the sperm-duct chamber is sometimes very small and the duct-like continuation of the atrium persists· The internal surface of the funnel as well as of the duct is lined with ciliated epithelium, but in the atrium the cilia are absent and the cells are taller and glandular. The outer surface of the whole organ is covered with peritoneal cells, which are conspicuously taller around the atrium. Between the inner and the outer epithelium there is a layer of circular and longitudinal muscle fibres' which are most strongly developed around the atrium and very thin in the funnel and the duct. There is no penis.

Alimentary Canal.

The alimentary canal is simple as in other Tubificidæ. The mouth lies on the ventral side of segment I; the pharynx is large and lies in segment II; the œsophagus is slender and extends through segments III and IV, the intestine beginning in segment V. The lumen of the intestine is about equal to that of the œsophagus, but as the former is surrounded by hepatic cells it appears externally thicker than the œsophagus. On the dorsal side of the pharynx there is a group of goblet-shaped unicellular glands with long necks opening into the basal portion of the ciliated epithelium of the pharynx. The ventral wall of the pharynx is very thick and is concave towards the ventrum. The œsophagus and the intestine are lined by a ciliated epithelium, which is followed by a layer of circular and of longitudinal muscle fibres. The intestinal wall is very rich in blood-vessels. In sections these are seen to be situated between the internal epithelium and the layer of circular fibres, and are traversed by connective tissue trabeculæ.

Nephridium.

The nephridia are present in segments VII—IX and in all segments posterior to XII inclusive except the last. In each nephridium we may distinguish three portions, the internal tubular portion, the middle enlarged portion, and the external tubular portion. The middle portion makes up by far the larger part of the whole organ, and reaches nearly the posterior septum of the segment on either side of the intestine; externally it is continuous with its fellow on the opposite side of the body, although the nephridial canals of the two are entirely separate. The external tubular portion opens to the exterior on the outer side of the ventral seta-bundle. The funnel is very small, and is somewhat sagitate or globular according as the ciliated process is thrown out or drawn in; the latter being formed by the ventral margin of the funnel. (In *V. pilosus* it is formed by the dorsal lip of the funnel.) The internal surface of the funnel as well as its margin is thickly covered with long vibrating cilia, and during life the ciliated process is contantly thrown out and drawn in. Sections show that there is a transverse constriction at its base, upon which it is folded when drawn in.



Cut 4.

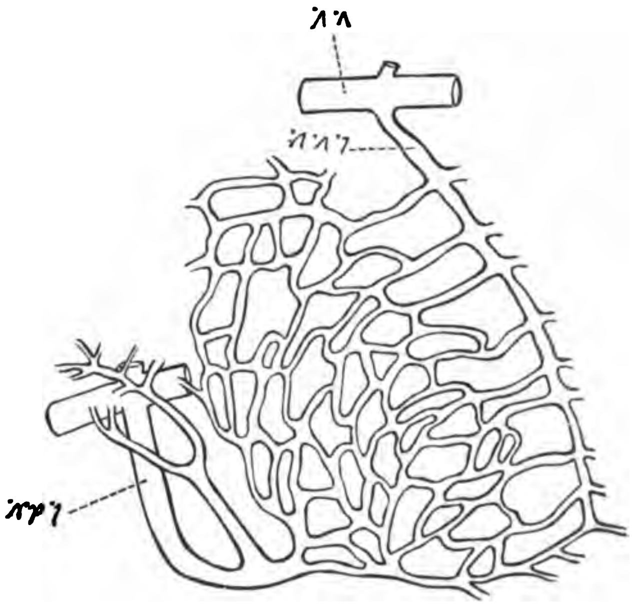
C.ext. Canal to the exterior, *n.c.* Nephridial canal, *n.f.* Nephridiostome, *n.p.* Nephridiopore.

There is only one nephridial canal of small calibre, which winds back and forth several times in the enlarged middle portion. The portion lying between the nephridiopore and the middle portion sends out several blind diverticula. The walls of the canal consist mostly of a syn-

citium, and the cell boundaries can be recognized only in the peripheral part. Here and there the canal is enlarged and forms the ciliated ampullæ.

Vascular system.

The main part are the dorsal and ventral vessels. The dorsal vessel divides into two in the prostomium, and these two vessels after dividing several times supply the brain and the body-wall of the most anterior part. The lateral vessels, which arise from the dorsal vessels, are very small in segments I, II, and III; they gradually become larger in segments IV—X, in which last segment they are considerably dilated. The largest lateral vessels lie, however, in segment XI, and from this on the lateral vessels are exceedingly small and just recognizable. The dorsal vessel alone beats, although the ventral vessel also executes some inconstant pulsatory movements. In each segment the dorsal vessel is provided with a group of valvular cells, which are also present in the constricted portions of the lateral vessels. These valvular cells are more numerous in the larger vessels; they are pear-shaped and contain a granular substance. The



Cut 5.

D.V. Dorsal vessel, *L.D.V.* Lateral dorsal vessel, *L.V.V.* Lateral ventral vessel, *V.V.* Ventral vessel.

dorsal lateral vessels are gradually enlarged from segment IV backwards, and the number of constrictions also increases.

The dorsal vessel divides into two also in the anal segment, in which it ramifies greatly.

The ventral vessel, like the dorsal vessel, sends out a pair of lateral vessels in each segment, which are continued into the corresponding vessels from the dorsal trunk, not directly as in most other oligochætes, but by the intermediation of smaller vessels.

The ventral vessel divides into two in segment III; these two branches proceed forwards and curving towards the dorsum in the first segment become continuous with the single dorsal vessel. A little in front of the point of separation of the two vessels just mentioned, these are united by a transverse vessel, from which is given off in the median line a branch which itself divides into two in segment I. These two vessels break up into smaller branches, which become continuous with the corresponding vessels of the dorsal side. Besides the lateral vessels corresponding to those of the dorsal vessel, the ventral vessel sends out another set of lateral vessels, which always alternate with the former.

The branching of the lateral vessels of the dorsal and ventral vessels is dissimilar. The dorsal lateral vessels divide successively, while in the ventral lateral we can recognize one main trunk, from which a number of smaller branches are given off symmetrically on either side.

In only a few among the many specimens that I have observed have I been able to demonstrate valvular cells in the ventral vessel; but their position is very variable, and they are mostly confined to the anterior part of the body.

Comparison of the two species.

	V. pilosus Goodrich.	V. limosus, n. sp.
Clitellum	X—XIII.	Wanting.
Sperm-duct.	Of uniform calibre throughout; only the middle portion appear swollen, owing to the tall peritoneal cells surrounding it; no atrium.	Gradually increases in calibre backwards; opens into a distinct atrium.
Nephridium.......	Begins in segment VI.	Begins in segment VII.
Oviduct............	Rudimentary.	Absent.
Sperm-sac.........	Anterior sperm-sac in segment IX; none in X; posterior sperm-sac extending through segments XI—XII.	A single sperm-sac extending through segments IX—XIII.
Ovisac.	Formed by the posterior septum of segment XI.	Formed by the posterior septum of segment XII.
Cilia-like process...	Uniformly present.	Absent in the anterior portion, thickly set in the posterior portion.

In view of the characters of the new species above set forth we must read in the generic diagnosis given by BEDDARD "*Clitellum X—XIII or absent*" instead of "Clitellum X—XIII."

Literature on Vermiculus.

BEDDARD, F. E.—A Monograph of the Order of Oligochaeta. 1895. P 271.

GOODRICH, E. S.—Note on a New Oligochaeta. Zool. Anzeiger, XV. 1892. Pp. 474—476, 2 fig.

" —On the Structure of Vermiculus pilosus. Quart. Jour. Mic. Sc, XXVII, N. S. 1895. Pp. 253 - 267, pl. 26—28.

Printed December 25, 1898.

INSECTS COLLECTED ON MOUNT FUJI.

By M. MATSUMURA.

Entomological Laboratory, Agricultural College, Sapporo.

Mt. Fuji as a collecting ground is noted from former days since the French Jesuits, as Abbé David and others trod the unbeaten path of entomological field, somewhat more than thirty years ago.

The time which is yearly allowed the public to ascend the mount, is from the latter part of July to the middle of September, especially for the purpose of religious devotion. Many foreign as well as native entomologists visit it every year. There are many insects which are peculiar to this mountain, and the species which are commonly found here are found to be rarer as we come down toward the foot. *Thecla ibara*, *T. orsedice*, *Niphundus fusca*, *Psychostrophia nelanargia*, *Schistomira funeralis* (*Bekkochō*), *Carabus fujisanus*, *Panorpa leucoptera*, etc. are all noted insects here; while many others have a close resemblance to those of Hokkaido.

I visited Mt. Fuji on July 21st and stayed there three days, devoting my time to the collection of insects. To say the truth, it was too early for collecting, and the noted insects known to be found here were not captured in my net, with a few exceptions. During my rambles I found *Tarobo* to be one of the best places for collecting. Here many trees and shrubs flourished, many flowers blossomed constantly and attracted gorgeous papilionids, such as *Papilio demetrius*, *P. alcinous*. The other common lepidopterous insects found near around here were the diurnals as *Neptis Pryeri*, *Lycæna Pryeri*, *Terias læta*, *Syntomis thelebus*, *Abraxas eurymedes*, *Vithora agrionides*. At night many heterocerous insects came to the light. Among them were the following ones: *Chærocampa elphenor*, *Spilosoma seratopunctata*, *S. menthastri*, *Cymatophora* 2 *sp.*, *Icterodes jaguaria*, *Hypena rhombalis* etc. As I ascended from "Tarobo" about five *cho*, I found that trees and shrubs suddenly gave way to dwarf shrubs and weeds, and next when I came to a place about 4,000 feet high no plants were to be seen except *Ontade—Polygonum polymorphum* var. *japonicum*, and a few shoots of a thistle, *Lenicus* sp. The *Polygonum* were matted here and there on the volcanic ashy soil and a few hypenid moths only flew away as they were disturbed. On ascending still further I came to the region occupied by

reddish volcanic rocks and sands. Here there was no vegetation at all. But still there were found geometrid moths as *Elphos latiferaria*, *Boarmia mœsta*, that flew away from about my feet as I trod up the course. Then I came to the place, commonly called *Rokugome*, where large blocks of rocks abounded and where I got *Calosoma mikado* accidently as I overturned a small stone. Here again I caught *Thecla smaragdina*, which I at first regarded as a new species, but on reflection was convinced, must be a variety of the above named species. Just at this time I saw a lycænid butterfly flying about the scattered stones, but the slope being 45° quite prevented me pursuing it. During this time which was spent for the travel from *Rokugome* to the top, where the shrine stands, I could catch no insect, being quite overcome by the very tiresome travel.

After starting from "Tarobo" at 4 o'clock in the morning we reached the top at 2 o'clock in the afternoon. The collection on the top was very poor and only the following insects were netted:—*Argynnis Paphia*, *A. nerippe*, *Pompilus biooulatus*, *Mallophora anicius*, *Endoiasimyia indiana*, *Gn ? sp ?*, *Musca corvina*, *M. domestica*, *Leucorrhina fujisana*. Among these the most common insect was *Mallophora anicius* (*Shioya-abu*). It was met everywhere we went, being easily discerned by its peculiar buzzing sound. If alights upon a stone awaiting for booty. It the prey comes within its reach, it darts off and clasps it with its feet.

The top of the mount was very cold and after one night's stay we were glad to descend, the more so on account of the scarcity of insects.

On the whole the field which is commonly called *Susono*, containing the large area between Gotenba and "Tarobo," is very rich with the hexapod tribe, especially the moths; but mammals, birds, reptiles, and amphibians seem to be very scarce; no mammals came across my path, and only two kinds of birds fell within my vision. One was a kind of swift called *Cypselus pacificus*, which was to be seen two or three in number on the mountain top, cutting the air with a loud cry; the other was a kind of lark, probably the species called *Alauda japonica* found at a sandy slope about 7,000 feet high.

The following insects were caught on Mount Fuji.

HYMENOPTERA.

Apidæ.

Bombus lapidarius, L. Illig. Mag. V. 169.

Megachile centuncularis, Latr. Hist. Nat.

Vespidæ.

Polistes hebræus, Saus. Mon. Guêpes.

Polistes yokohamæ, Rad. Hor. Soc. Ent. Ross.

Monobia biangulata, Saus. Syn. Am. W.

Crabronidæ.

Cerceris unifasciata, Sm. Cat. Hym.

Ammophila infesta, Sm. J. E. S.

Ammophila sp.

I have never seen this species before. It may be a new species. But as I have not yet been able to identify it I cannot speak with certainty. ♀ Length 28 mm.—general form is much like *A. sabulosa*, but the abdomen is steel blue and the petiole glittering black except the lower part of the 2nd petiolewhich is red.

Ammophila sp.

This is very much like *A. impatiens* of Australia (Tran. Ent. Soc. 1878), except the face not being pubescent with silvery hair, and the first joint of the apical abdomen not being ferrugineous. This is a very common species on the sandy road as is also the former species.

Pompilidæ.

Pompilus biocculatus, Kirby. P. Z. S. 1893.

Scoliadæ.

Scolia quadrifasciata, Fabr. Syst. Piez.

Myrmicidæ.

Leptothorax molesta, Say. Bost. Jour. Nat. Hist.

Lasius fuliginosus, Latr. Hist. Nat. Fourm.

Aphænogaster famelica, Sm. T. E. S. 1874.

Formicidæ.

Polyrhachis sexspinosus, Latr. Hist. Nat. Fourm. 1874.

Polyrhachis lamellidens, Sm. T. E. S.

Camponotus ligniperdus, Latr. var. *obscuripes*, May. B. A. F. A. 1878.

Camponotus vitiosus, Sm. T. E. S. 1874.

Ichneumonidæ.

Anomalon sp.

Campoplex sp.

Tenthredinidæ.

Hylotoma pagana, Danz. Fauna Germ. 1293.

Allantus, n. sp.

This is not described in the "List of Hymenoptera" Vol. 1. of Kirby 1882, nor in any other paper we have yet found. Probably it may be a new species. Length 12 mm.—black with a violetious luster, labrum pale white, middle of antennæ and the basal 3 segments of the abdomen at the venter pale gey; wings fuscous.

COLEOPTERA.

Cicindellidæ.

Cicindella japonica, Guer. Rev. Zoolog. 1847.

Carabidæ.

Calosoma mikado, Bates, Geod. 235.

Staphylinidæ.

Staphylinus paganus, Sharp. T. E. S. 1874.

Lucanidæ.

Macrodorcas rubrofmoratus, Sn. V. Vollh. Tijd. E. 1868.

Scarabidæ.

Bolbocerus nigroplagiatum, Wat. T. E. S. 1875.

Apogonia major, Wat. T. E. S. 1875.

Anomala testaceipes, Mostch. Et. Ent. 1860.
Onthophagus ater, Wat. T. E. S. 1875.

Elateridæ.

Lacon binodulus, Motsch. Et. Ent. 1860.

Telephoridæ.

Macrolycus flavellatus, Motsch. Reise. Amur. 1860.
Luciola vitticollis, Kies. Berl. E. Z. 1874.

Tenebrionidæ.

Plesiophthalmus æneus, Motsch. Et. Ent. 1861.

Mordellidæ

Mordellistena signatella, Mars. Ann. France. 1876.

Chrysomelidæ.

Melasoma ænea, L. Syst. Nat. 1767.
Sphenoraia melanocephala, Jac. P. Z. S. 1885.

LEPIDOPTERA.

Papilionidæ.

Papilio demetrius, Cram. Pap. Ex.
Papilio alcinous, Klug. Neu. Schmett.

Pieridæ.

Terias læta, Boisd. Sp. Gen.
Colias hyale, L. Syst. Nat.

Lycænidæ.

Niphandus fusca, Butl. P. Z. S. 1881.
Thecla smaragdina, Brem, Lep. Ost-sib.
Polymmatus phlæas, L. Syst. Nat.
Lycæna argiades, Pallas, Reisen,

Lycæna argia, Men. Cat. Mus. Petr.
Lycæna argiolus, L. Syst. Nat.
Lycæna Pryeri, Mur. Ent. Mon. Mag. 1873.

Nymphalidæ.

Apatura ilia, Schiff. S. V. 1776.
Limenitis sibylla, L. Syst. Nat.
Neptis Pryeri, But. T. E. S. 1871.
Neptis aceris, Lepechin, Reise.
Neptis lucilla, Schiff. S. V. 1776.
Vanessa cardui, L. Syst. Nat.
Vanessa c-aureum, L. Syst. Nat.
Argynnis paphia, L. Syst. Nat.
Argynnis nerippe, Feld. Wien. Ent. Mon. 1862.

Satylidæ.

Mycalesis gotama, Moore. Cat. Lep. 1857.
Ypthima baldus, Fabr. Syst. Ent.
Satyrus dryas, Scop. Ent. Carm.
Lethe sicelis, Hew. Ex. Butt.
Neope callipteris, Buth. Ann. & Mag.

Hesperidæ.

Pterygaspidea sinica, Feld. Wien. Ent. Mon. 1862.
Daimio tethys, Men. Enum. 1855.
Isoteinon lamprospilus, Feld. Wien. Ent. Mon. 1862.
Pamphila pellucida, Murrey, Ent. Mon. Mag. 1875.
Pamphila varia, Mur. Ent. Mon. Mag. 1875.
Hesperia sylvanus, L. Syst. Nat.
Hesperia flava, Murrey, Ent. Mon. Mag. 1875.

Sphingidæ.

Hemaris radians, Walk. Cat. Lep. Het. 1856.
Macroglossa bombyliens, Boisd. Sp. Ger. Lep. 1876.
Deilephila Galii, Fabr. Sp. Ins. (Larvæ).

Chærocampa elphenor, L. Syst. Nat.

Zygænidæ.

Syntomis thelebus, Fabr. Ent. Syst.
Pryeria sinica, Moor. An. & Mag. 1877.

Arctidæ.

Stigmatophora flava, Brem & Grey. Schmet Nord. China.
Spilosoma seratopunctata, Motsch. Et. Ent. 1860.
Spilosoma menthastri, Fabr. Ent. Syst. 1853.
Bireta pallida, But. A. M. N. H. 1877.

Bombycidæ.

Clisiocampa neustra, L. Syst. Nat. (Egg).
Gastropacha pini, L. Syst. Nat. (Larva).
Numenes disparilis, Staud. Rom. Men.

Liparidæ.

Lymantria aurora, var. *fusca*, Leech. P. Z. S. 1887.

Cymatophoridæ.

Cymatophora sp. (N. sp. ?)

Primaries fuscous, costal margin broadly grey, tinged with a pinkish shade, orbicular grey, outlined in fuscous with a center of the same color; reniform closely in contact with the orbicular, is also grey out-lined in fuscous with a central same colored line and a same colored mark basally; outer side of the reniform is of a white color with a denticulated fuscous line transversely; toward the outer margin there are two black obscure, transverse bands, one of them being bordered with a grey internally; secondaries also fuscous a little deeper toward the outer margin. Wing Exp. 51 mm. Corp. L. 20 mm.

Cymatophora sp. (N. sp. ?)

Primaries long narrow, grey with greenish and reddish shades, mottled with many small reddish brown punctures, double curved bands near the base reddish brown, orbicular absent, reniform black nearly crescent form, costal margin mottled with blackish markings, waveline ("Wellenlinie") black internally

bordered by a brownish green band, with a few violet tinge in a certain light; secondaries greyish, shining.

Wing Exp. 39 mm. Corp. L. 12 mm.

Geometriformidæ.

Catocala sp. (N. sp. ?)

Somewhat resembles that of the noctuid moth, *Triphænopsis lucilla*, Butl. in its general aspect. Wing Exp. 48 mm. Corp L. 22 mm. Reniform white and very large.

Dendrometridæ.

Spilopera debilis, Butl. Typ. Lep. Het. 1878.
Chærodes dictynna, Butl. Typ. Lep. Het. 1878.
Deroca phasma, Butl. Typ. Lep. Het. 1878.
Boarmia mœota, Butl. T. E. S. 1861.
Elphos latiferaria, Walk. Typ. Lep. Het. 1878.
Abraxas eurymedes, Motsch. Et. Ent.
Vithora agrionides, Butl. Typ. Lep. Het. 1878.
Icterodes jaguaria, Guen. Phal. 1857.
Icterodes fraterna, Butl. Typ. Lep. Het. 1878.
Abraxas languidata, Walk. Cat. Lep. Het. 1862.
Thalassodes ambigna, Butl. Typ. Lep. Het. 1878.

Phytometridæ.

Scotosia certata, Hübner. Pap. Tab.

Pyralidæ.

Marmorinia amphidecta, Butl. Typ. Lep. Het. 1878.
Hypena rhombalis, Guen. Delt. 1854.
Hypena zilla, Butl. Typ. Lep. Het. 1878.
Herminia albomaculatis, Brem. Lep. Ost-sib. 1864.

DIPTERA.

Tipulidæ.

Phachyrhina sp.

Tabanidæ.

Tabanus yokohamæ, Bigot. Mem. Soc. Z. F. 1891.

Tabanus striatus, Fabr. Ent. Syst.

Asilidæ.

Mallophora anicius, Wk. List. Brit. Mus. 1854.

Promachus yezonicus, Bigot. Bull. Ent. Fr. 1887.

Promachus sp.

Dasypogon japonicum, Bigot. Bull. Sec. Ent. 1887.

Laphria auricincta, V. d. Wulp? Tijd. V. Ent. 1872.

Therevidæ.

Thereva marginula, Meig. Sys. Besch.

Syrphidæ.

Syrphus balteatus, de Geer. Mém. 1780.

Syrphus ribesii, L. Syst. Nat.

Syrphus sp.

Eristalis nemorum, Fabr. Ent. Syst.

Eristalis tenax, L. Syst. Nat.

Endoiasimyia indiana, Bigot. Ann. Soc. Ent. 1874.

Cheilosia sp.

Gn? sp?

I have never seen nor heard of this dipterous insect before, and could not find any allied genus which exactly coincides in its character, neither in Meigen's "Systematische Beschreibung" nor in any other book to which I have access. Form of the antennæ and the thorax is very much like that of the genus *Chrystoxm,* But the venation is quite different, rather resembling that of the genus *Eristalis,* the third longitudinal vein bring curved much. It is the only specimen I have ever caught and so can not be sent away to be identified. I wil[now describe its character briefly.

Corp. L. 16 mm.

Wing Exp. 30 mm.

Antennæ black, antennal peduncle and the vertex purplish, face, collar, isdes of the thorax, scutellum except the dish, 4 curved marks on each side of the

abdomen, and the legs yellow; thorax æneus with 2 longitudinal greenish yellow streaks; abdomen black, apical margin of each segment more or less dull yellow; wings hyaline with a fawn shade especially at the costal margin.

It was caught at the top of the mount about 12,000 feet high where the insect rested upon a reddish volcanic stone, warmed by the vapors that arise from the internal heat.

Muscidæ.

Musca corvina, Fabr. Spec. Insect. 1781.

Musca domestica, L. Faun. Suec. 1833.

Cyrotoneura sp. ?

Sarcophaga sp.

This much resembles the species *S carnaria*, L. but can be easily distinguished by the colors of the venation.

Cynomyia violacea, Macg. Suit. a Bull. 1834.

Echinomyia fera, L. Syst. Nat.

APHANIPTERA.

Pulicidæ.

Pulex irritans, L. Syst. Nat.

RHYNCHOTA.

Pentatomidæ.

Halyomorpha picus, Fabr. Ent. Syst. (Nymph).

Acanthosoma distinctum, Dall. Brit. M. List. 1851.

Coreidæ.

Homœocerus punctipennis, Uhl. Proc. Acad. Ph. 1860.

Lygœidæ.

Pamera hemiptera, Scott. A. & M. 1874.

Cicadidæ.

Pomponia japonensis, Dist. Monog. Orient. Cicad. 1892.

NEUROPTERA.

Panorpidæ.

Panorpa macrogaster, M'Lach. An. Soc. Ent. Belg. 1872.

Leptopanorpa Ritsemæ, M'L. An. Soc. Ent. Belg.

Hemorobidæ.

Chrysopa intima, M'L. A. S. E. Belg.

Osmylus sp.

PSEUDONEUROPTERA.

Libellulidæ.

Diplax elata, Selys. Ann. Soc. Ent. Belg. 1872.

Thecadiphax crotica, Selys. Var. fastigiata, Selys. Ann. Soc. Ent. Belg. 1883.

Leucorrhinia fujisana, sp. nov.

Abd. ♂ 24 mm. ♀ 20 mm., post. wing ♂ ♀ 28—29 mm. Corp. brownish yellow, wings hyaline, costal margin orange yellow, also the menbranule and the basal half of the wing. Pterostigma greyish yellow (length 3 mm.). Reticulations black, but the costal, the basal and the menbranule yellow; anticubital cells 8; post-cubitals 10; the triangles show nothing unusual. This beautiful insect is very common at the top of the mount resting upon the warm heated rocks, but is not to be seen any where as we come down to the level.

Pseudothemis nigrifrons, sp. nov.

Abd. ♂ 35 mm. Post. wing ♂ 39 mm. This much resembles *P. zonata*, Burm., but differs; first, wings are transparent with a purplish luster; secondly, pterostigma large (4 mm. long); thirdly anticubitals 19; postcubitals 13; fourthly head with the face glittering black, the part of the pronotum streaked with a broad yellow band longitudinaly which is divided in the middle by a narrow black line; fifthly, the third and the fourth abdominal segments are not wholly yellow, but interrupted by black lines and marks, the fifth segment also with a yellow mark at the venter; sixthly the superior caudal appendage is yellow except at the base.

Epophthalmia elegans, Hagen. Brauer. Vog. Nov.

Gomphus Pryeri, Selys. Ann. Soc. Ent. Belg. 1883.

	Actual Length in				of Head con- in the Dis- e between		With respect to the proportional Lengths of the Head & Dist. bet. G.O. and D. are
	No.	T.L.	Head.	G.O.-D.	G	D. G.O &V.	
Tokushima, Shikoku.	66	377	49	63	1	$2\frac{2}{49}$	*vulgaris.*
	67	379	52	65	1	$2\frac{1}{52}$	"
	68	385	56	70	1	$2\frac{1}{56}$	"
	69	390	50	72		$2\frac{9}{50}$	"
	70	396	53	74	1	$2\frac{4}{53}$	"
	71	410	55	73	1	$1\frac{53}{55}$	"
	72	416	56	83	1	$2\frac{3}{56}$	"
	73	420	56	73	1	2—	"
	74	421	59	74	1	$1\frac{58}{59}$	"
	75	496	68	93		$2\frac{1}{17}$	"
Asahigawa, Mimasaku.	80	391	49	74	1	$2\frac{8}{49}$	*vulgaris.*
Lake Jinzai, Idsumo.	5	207	24	39		$2\frac{1}{4}$	Between *bost.* & *vulg.*
	6	235	28	42		$2\frac{3}{28}$	*vulgaris.*
	7	256	30	43		$2\frac{4}{15}$	"
	8	298	33	55		$2\frac{1}{3}$	*bostoniensis.*
	9	336	37	61		$2\frac{9}{37}$	Between *bost.* & *vulg.*
Shinju Lake, Idsumo.	10	421	54	76	1	$2\frac{6}{27}$	*vulgaris.*
	11	435	50	87	1	$2\frac{11}{25}$	*bostoniensis.*
	12	445	56	80	1	$2\frac{9}{56}$	*vulgaris.*
	13	451	54	90	1	$2\frac{19}{27}$	*bostoniensis.*
Tottori Market, Hoki.	14	249	30	43		$2\frac{1}{30}$	*vulgaris.*
	15	268	34	44		$2\frac{1}{17}$	"
	16	288	36	52		2 [illegible]	
	17	385	42	69			